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The Crist Vibrating Piston Engine.

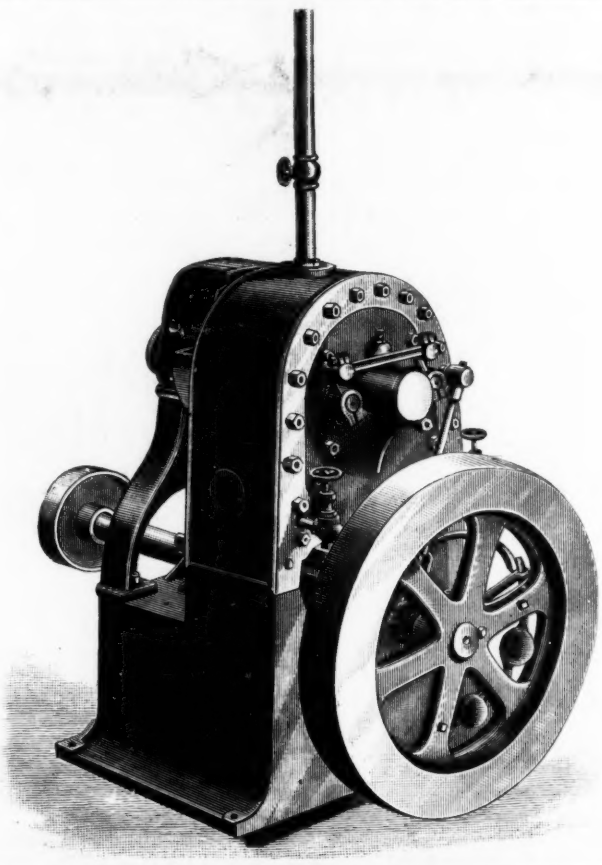
In our issues of April 5 and May 3, 1884, we published cuts showing some forms of this engine, which was then built with the crank-shaft at the top, and used for direct driving of exhaust fans, and for general light driving purposes. Since that time the engine has been re-designed, bringing the crank-shaft at the bottom, thus giving it greater steadiness, and adapting it for use on yachts, steam launches, etc. It has also a fly wheel governor, which, by varying the throw of the eccentric, gives an automatic variable cut-off, instead of controlling the speed by throttling, as formerly.

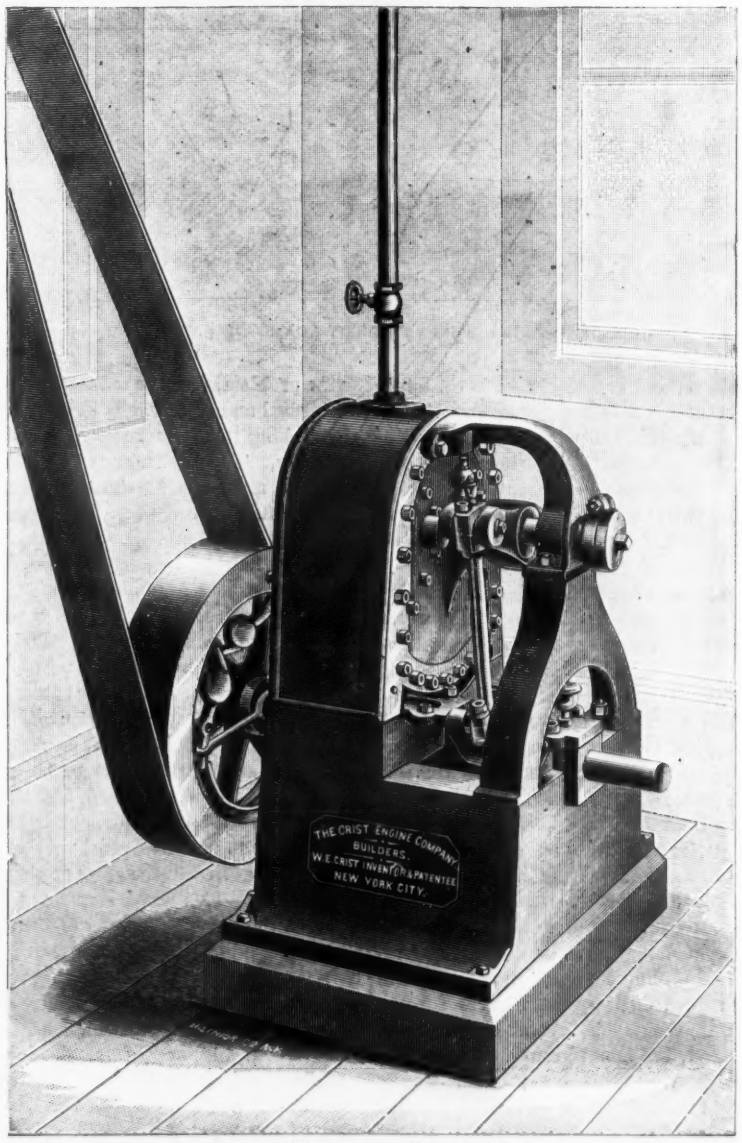
In a short time we shall publish cuts showing the details of construction, together with indicator diagrams, and therefore defer a detailed description until that time. At present it is sufficient to say that the upper one of the two shafts, is a vibrating shaft, motion from which is transmitted to the crank-shaft below by means of the arm and connecting-rod shown in the engraving at the bottom of the page, in which the engine is shown as used for driving machinery; while the other is a view of the opposite side, showing the valve motion and the engine as arranged for coupling direct onto a propeller or other shaft.

In this view the ends of the valve stems are shown, one each side of the vibrating piston-shaft. These valve stems are actuated by means of connected bell cranks, which are controlled by an eccentric and rod, as shown. The valves are of the Corliss type. There are two pistons attached to the vibrating shaft, one above and the other below it, the one below being of the larger area. These pistons are rectangular in shape, and vibrate back and forth with the piston-shaft as a center. The steam is first used upon the upper piston, and from there exhausted to the lower one, thus making the engine of the compound type.

Dispensing as it does with reciprocating pistons, piston-rods and crossheads, reduces the weight of the parts which cause injurious vibration to a minimum, and also greatly lessens the friction, while for compactness and economy of space, as well as lightness, especially considering that it is a compound engine, it is somewhat remarkable; a 50 horse engine, weighing only 2,700 pounds, and occupying a floor space of 9½ square feet. It can be run with safety at very high speeds, the smaller sizes running at 450 to 550 revolutions per minute. This makes it possible to couple it direct to the shaft of dynamos, looms, printing presses, fans, propeller wheels, centrifugal pumps, and other machines where a high speed is required. Six twelve horse engines are used in this way for running presses in the office of the N. Y. *Times*. They run at a speed of 450 revolutions per minute, and have been running very satisfactorily for over a year; the engineer in charge of them stating that they are remarkably tight, and give no trouble whatever. Their compactness is especially valuable for marine purposes, as it enables the engine to be placed entirely below the water line, thus lowering the center of gravity. The valves are practically balanced, and since the steam is acting upon both the pistons at once, the side thrust upon the vibrating shaft is also balanced. Other features of the engine, such as the arrangement of the packing, and its economy in the use of steam, will be treated of when the detail cuts and indicator cards before alluded to are published.

The engines are made by the Crist Engine Mfg. Co, 149 Broadway, New York city.





THE CRIST VIBRATING PISTON ENGINE.

Making Taps of Standard Size.

BY FRED J. MILLER.

In shops carrying on a line of manufacture in which the standard of workmanship is high, and interchangeability of parts is one of the objects sought, the problem of keeping accurately to standard with taps and the screws to fit the holes tapped by them is recognized as being one presenting considerable difficulty in its practical solution. A great many mechanics are interested in the matter, and the number of questions received by the editor relating to it, shows that there are many who are entirely unacquainted with the best methods of attaining the desired ends. Such questions cannot be answered satisfactorily within the limits of the column devoted to questions, and it is one object of this article to answer several questions which have been received relating to the subject.

Amongst the machine shops which have progressed sufficiently to know and appreciate the value of a uniform standard of screw threads, the advantages of the adoption of the Sellers, or United States standard, over the old style V threads is also almost universally understood, and probably in a large majority of cases, where anything like a complete system for the purpose of keeping to standard is in use, the U. S. standard thread has been adopted.

Aside from the consideration of the superior strength of a screw having threads flatted at top and bottom, they, and the taps as well, can be much more cheaply kept to standard size, for reasons which will hereafter appear.

On many accounts it is very desirable that this standard should be universally adopted, and for this reason, as well as the others mentioned above, this article will treat only of U. S. standard threads; though, of course, it is obvious that many of the methods will apply equally well to the sharp V threads.

The Pratt & Whitney Co., who have devoted a great deal of time and attention to this subject, have kindly consented to the use of some of their cuts for use in this article, all except Figs. 1 and 4 (page 2), being either from their catalogue or their book, *Standards of Length and their Practical Application*.

Since the bearing surfaces of screw threads are intended to be upon the sides of the threads only, it is evident that it is preferable to measure or gauge the size by the sides instead of by the outside diameter, or by the bottom of the thread. But since it is obviously impossible to measure the sides of the thread by the use of the ordinary micrometer or vernier caliper, it follows that the only way this size can be determined by the use of such calipers is by resorting to the measurement either of the outside diameter, or the bottom of the thread; and then, by the use of a properly shaped tool, securing the proper relation between these sizes and the size of the part the accuracy of which it is desired to ensure.

So far as I know, there is no way of doing this by turning the outside diameter to exact size, and then gauging the depth of the chas-

ing tool from that, which is at all satisfactory. Of course, theoretically, a tool ground accurately to the proper angle, and flatted to just the right amount, could be used for the chasing, and the threads cut to such a depth as would bring the flats at the top of the thread to the same width as those at the bottom, when, of course, everything would be just right. But practically, it is impossible to measure this width with sufficient accuracy, and the least variation in its width makes an inadmissible variation in the size of the tap.

A way in which a very fair approximation can be obtained—close enough for the work done in many shops—by the use of the micrometer caliper only as a gauge, is shown in Fig. 1. Of course it is well understood that the size of a tap at the bottom of the thread bears a certain definite relation to the outside diameter and to the pitch, and there are tables published giving this size for each of the various sized taps; but, in the absence of such a table, it is found by the formula

$$d = D - \frac{1.3}{n}$$

where d = the diameter at the bottom of thread, D = the outside diameter, and n = the number of threads per inch. For example, if the size of a 1 inch tap at the bottom of the thread is desired, 1.3 ÷ 8 (the number of threads per inch) = .1625, and 1″ − .1625 = .8375″, the size at the bottom of thread. Now, supposing a 1″ tap is to be made, the shank, for a short distance above the portion to be threaded, may be turned accurately to a diameter of .8375″ by the micrometer, and the chasing of the threads carried on until the point of the tool just touches that part, as shown at Fig. 1. Of course it is evident that where this method is used very much depends upon the accurate shape and setting of the tool, since, unless its sides are ground at precisely the proper angle, and just the right amount is ground off the point for the flat, the threads will not be the right size at the sides when the point of the tool touches.

Without the use of some special appliance for the purpose, it is impossible to grind these tools to gauge accurately enough to obtain anything like satisfactory results, and chiefly for this reason it is preferable to use tools specially made for the purpose, one of which is shown at Fig. 2, with a cutter detached at Fig. 3 (the latter full size.) They are ground accurately to shape by special appliances, after hardening, and when care is taken in sharpening them to preserve the original angle of the top face (upon which all the grinding is done), and they are properly set in the lathe, very fair results can be obtained by using them in this way.

A method by which greater accuracy can be secured, is by changing the flat contact surfaces of a micrometer caliper into small spheres, and measuring the sides of the threads directly, in the manner shown in Fig. 4. It is very evident, however, that the reading of the micrometer screw, when used in this way, will bear no definite relation to the normal size of the tap, but, nevertheless, it is plain that the reading will be the same upon two screws which are just alike in every respect, and it is upon this latter fact that the value of the method depends. Having a screw, or standard screw plug gauge, such as is shown in Figs. 5 and 6, the caliper having the little spheres can be adjusted until they will just pass easily through between the threads and the reading of the micrometer noted; then the tap which is to be made can be chased until the spheres will pass through its threads in the same manner and at the same reading; it is then evident that, if the thread is of precisely the same shape, the two screws (the plug and the tap) are of the same size. It will be noticed that the engraver has apparently taken considerable pains to avoid representing the spheres as such, but the idea will be understood, nevertheless. This method of measuring also originated at the Pratt & Whitney Co.'s, I believe. Of course any screw may be taken as a standard, and accurately reproduced in this way, but if the actual U. S. standard is aimed at, it is, of course, better to obtain the standard plugs of parties who are equipped for their accurate production. Such plugs as shown in Figs. 5 and 6 are furnished by the makers, accurately ground in the threads to the exact size and pitch after hardening, and where the greatest possible accuracy and uniformity is desired are, of course, indispensable.

In connection with them are used the screw thread receivers, Fig. 7. These are made of a flat piece of steel, having a threaded hole through it, and cut open, as shown. Two pins are put through it, extending from one side to the other, one each side of the hole; the object of the pins being to bring the two sides of the gauge into proper relation with each other after hardening, and to keep them so in use. Then out towards the end there are two screws, by one of which the gauge can be drawn together and made smaller, while by the other the opposite effect can be produced. By means of these screws the gauge can be adjusted to accurately fit its corresponding plug gauge, and can then be used to gauge taps or screws.

No matter what method of gauging may be adopted, it is, of course, of vital importance that the tool should be of the proper shape, and accurately set in the lathe, with its center line at right angles to the center line of the tap, and with its top face lying in a line radiating from the center—not necessarily level with it—as shown in an article on this subject by the present writer, in the American Machinist of March 26 and April 9, 1887.

It is important to see to it that in finishing the threads the tool has not become dulled on the point to any appreciable extent, especially if the first-named method of gauging is employed, because it is evident that, if the tool be worn, and the chasing be continued until the point of the tool touches that part of the tap which has been turned to the size of the bottom of the thread, the size in the threads will be too small, by an amount just equal to twice the amount which has been worn from the point of the tool. It is better, on this account, to use the accurately ground cutter for finishing only, and for all but a few finishing cuts to use either an ordinary tool ground by hand, or another form of cutter furnished by the makers for the tool, Fig. 2, which has several cutting teeth like a chaser, but is not ground to shape after hardening. With this the threads can be roughed out much faster than with a single tool.

Usually but little attention need be paid to the outside diameters of taps when made in this way, except to make them large enough. If they are made somewhat larger than the normal size, the only apparent difference will be in the width of the flat at the top, which will be narrower. The actual size of the thread upon the sides will be unaffected by it, and indeed it is preferable usually to make taps somewhat larger outside, the effect of which is, to tap the holes so as to leave a space at the top of the thread, as shown by Fig. 8, provided the outside diameter of the screw is kept to standard, as it should be; and this space does no harm, but is really beneficial, as it gives room for particles of dirt to lodge without affecting the fit of the screw.

Another advantage of this is, that it has been found in practice to extend the life of the tap to a remarkable degree, because the chief wear upon the tap comes upon the extreme points of the threads, and if left large enough to come to a sharp point, instead of being flatted, the points must wear off to that extent before the fit of the holes tapped by it will be affected, provided the bolts are kept to standard diameters outside.

Mr. Chas. A. Bauer has applied this to another important feature of this standard screw problem, *i. e.*, the reduction to standard of finished and rough bolts in the same shop, and making them interchangeable one with the other. The establishment of which he is manager makes large quantities of rough bolts for its own use, and at the same time a good deal of tool and special work is done, for which finished bolts and screws are used, besides those made upon screw machines for the regular work. All the rolling mills furnishing round iron for making rough bolts in his shops are furnished by him with limit gauges, by duplicates of which all iron received is tested, and, if the variation exceeds the limit, rejected. This limit falls considerably within the amount necessary to be added to a flat thread to make it sharp, and all taps for tapping nuts to be used on such bolts are left large enough outside to come up sharp when the size measured in the sides of the threads is standard. This leaves sufficient difference between the outside diameter of the taps and the largest admissible size of the rough iron, to allow for some wear upon the former before the fit is affected; and holes tapped by the standard hand taps, which are used for other work, and are of standard diameter outside as well as in the threads, will fit the rough bolts when the tops of the threads are filed off a little; at the same time, nuts tapped for the rough bolts will fit those which are turned and chased in the lathe, or made in the screw machine. In short, the whole system is reduced to a uniform standard, and yet allowance is made for the unavoidable variation in size of rough iron.

Hand taps are usually made standard size, and the character of the fit of the screws determined by varying the size of the screws; but machine taps are ordinarily made some what above standard size, to allow for wear of the taps, and for easy fits of the nuts; the excess being, on the different sizes of taps, from two to ten thousandths of an inch, depending also, of course, upon the character of the work.

No fixed rule can be given for allowances to be made for alteration in size by the process of hardening, because it is impossible to foretell just what a piece of steel will do when hardened. About the best that can be done is to select some good brand of steel suitable for the purpose (it don't pay to make taps of poor steel), and test it to find out what it is most apt to do under given treatment in hardening; then, if the same steel is used all the time, and it is given the same treatment, reasonably uniform behavior may be expected, and its probable variation one way or the other allowed for. Forging is apt to make the results more uncertain than if the steel be cut from an annealed bar, and turned to size without forging, and a tap which has been forged should be thoroughly annealed then roughed out, and finally annealed again, to take out all strains put into the metal by the hammering before it is finished; and in fact, when the greatest accuracy of size and pitch is desired, it is best to anneal after roughing in all cases, whether the tap has been forged or not.

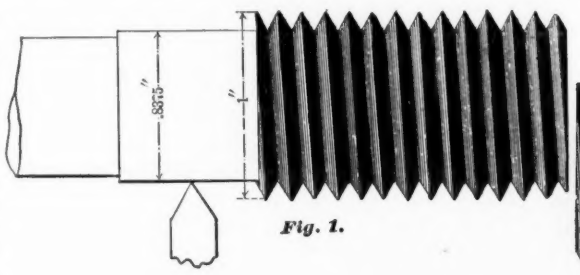


Fig. 1.

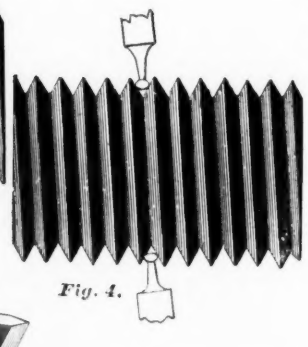


Fig. 4.

Fig. 2.

Fig. 5.

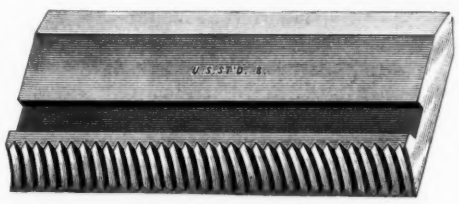


Fig. 3.

Fig. 6.

Fig. 7.

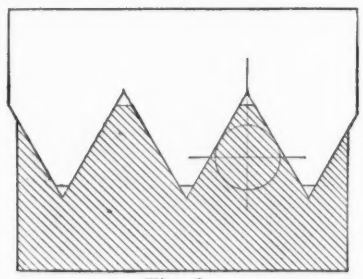


Fig. 8.

Making Taps of Standard Size.

Pressures in Moulds.

By S. Bolland.

First Paper.

Cast-iron in a liquid or molten state, has the power to transmit pressure to every part of the mould into which it is poured, and each part of the mould—when it is full—sustains a pressure equal to the weight of a column of cast-iron, reaching from such part to the upper surface of the running basin.

Let a mould be prepared similar to the one shown at Fig. 1, page 3, which represents a plain bar one inch square, and twelve inches long, with graduation marks at each inch of its length. Now, suppose iron is poured into this mould, to the depth of one inch; it is plain that the weight of one cubic inch of iron is the pressure which the bottom surface of the mould must resist; and it is equally plain that the pressure on the bottom surface will be twelve times that amount when the mould is full. And because, as above stated, of the power of liquid iron to "transmit pressure in every direction," each of the four sides of the bottom inch must bear the whole pressure, as long as the iron is in a liquid state.

The pressure at each graduation ascending, decreases by exactly the weight of one cubic inch of cast-iron; thus, the pressure at each mark equals the weight of a column of cast-iron one inch square reaching to the surface. Let it be required to find the pressure at 6 inches deep.

Weight of 1 cubic inch.....	.26 lb.
Depth, in inches.....	6
Pressure, in pounds.....	1.56

This shows that the pressure at one-half its depth equals a little over 1½ pounds. It must not be thought that because we have chosen a column having one square inch for its base, that the reasoning applies only in this case; the same reasoning applies to every form or magnitude of base. Suppose the column to be 12 inches instead of one, and 12 inches deep; the bottom surface of such a mould would have to resist a pressure equal to the weight of molten iron resting upon it, or 450 pounds, and the pressure against each square inch of the sides would be equal to the weight of a column of iron whose base is a square inch, and whose height is equal to the depth from the upper surface to that part of

the side surface it may be desired to calculate for.

Let it be required to find the pressure at 6 inches deep, of the side 12 inches square.

It has been shown that the pressure at 6 inches deep for one square inch is 1.56 pounds. Therefore,

Pressure for 1 square inch, 6 inches deep	1.56
Multiplied by width of side	12
Total pressure in pounds	18.72

This gives the pressure at 6 inches deep as nearly 19 pounds, or equal to the weight of 12 columns whose bases are each one inch square, and whose height is 6 inches, as seen at Fig. 2.

It must be understood that not only the surface of the mould, but every portion of the molten iron, sustains a pressure from the weight above it, and that this pressure is governed by the same law; in other words, every square inch of the surface of this cube is pressed by the surrounding metal whilst in a fluid state, and the amount of pressure which every square inch sustains is exactly the weight of the column of metal which stands above it.

The fact of the liquid iron coming to a state of rest after the mould is full, proves that these forces must be equal in any direction, and that, whatever be the pressure outwards on the side of the mould, the same force is being exerted in the opposite direction; so that every one of the 144 square inches contained in the square foot stands as it were on its own basis, exerting an equal pressure in every direction and on every side.

From the foregoing the following general law is deduced: "The pressure exerted at any depth below the surface is always equal to the weight of a column of cast-iron whose height is equal to the depth, and whose base is equal to the surface over which the pressure is extended."

It has been clearly demonstrated that every part of a horizontal surface, at the same depth, sustains the same pressure. I will now endeavor to show how the pressure is exerted on the perpendicular sides of the mould in question. At Fig. 3 the side is divided into inches. Annexed to the several divisions on one of the sides is the amount of pressure in pounds exerted laterally at that particular depth from the surface when the mould is full. It is by the aid of this figure that I propose to show the method of finding the whole amount of pressure exerted on each side of the mould under consideration. This, clearly understood, will furnish a sufficient rule by which to obtain the correct sum of the pressure on the sides of any other mould, of whatever dimensions. (This figure also gives the amount of vertical pressure in pounds on the whole surface at the several depths indicated.)

At lateral pressures the amount for one inch in depth is 3.12 pounds (this means, of course, across the whole side), increasing by just the weight of an additional inch down to 12 inches, where it is seen to be 37.44.

Now, as this increase is seen to be uniform, one-half of the depth must be the average pressure of the whole surface, and will be found at 6 inches.

To prove this, at 6 inches deep the pressure is 18.72 pounds—exactly one-half of 37.44 pounds—which represents the extreme pressure at 12 inches deep. Now, take the pressure sustained at 7 inches, one below, and at 5 inches, one above, and we have 21.84 pounds and 15.6 respectively; add these together and we get 37.44 pounds, of which sum 18.72 pounds is one-half. Or take the pressure at 8 inches deep, which is 24.96 pounds, and at 4 inches—the pressure at which point is 12.48 pounds—and we obtain the same result. If each of these points sustained a pressure of 18.72 pounds, which is the average pressure, we should have the same total.

The same reasoning will apply to all the points equally above and below the middle point, 6 inches; the pressure on each point below it exceeds the pressure at 6 inches by exactly as much as the pressure on a point equally distant above it falls short of the pressure at 6 inches, and, therefore, on account of this mutual compensation, a general average is obtained.

It is clear that the total pressure on each side must be the whole 12 divisions multiplied by the amount of the average pressure, which is always found at half the depth of the liquid iron, and in this case is found at point 6 inches, at which point the pressure is 18.72 pounds. According to the above reasoning, the total pressure is the same as if this average pressure was uniformly diffused over the entire surface of the sides in contact with the liquid iron. Therefore:

Number of divisions	12
Multiplied by average pressure	18.72
Total pressure on side	224.64

Again, it appears that the total pressure exerted on the perpendicular side—when the mould is full—is just the same as if the side was taken for a horizontal bottom, and half the depth of the liquid iron rested thereon.

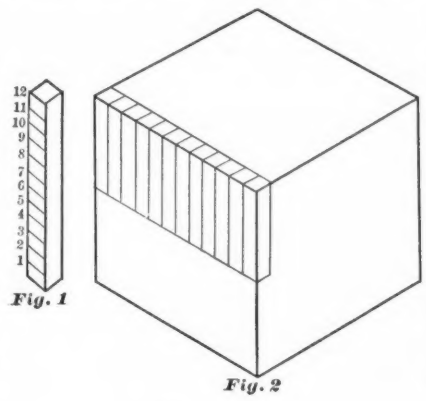


Fig. 1

Fig. 2

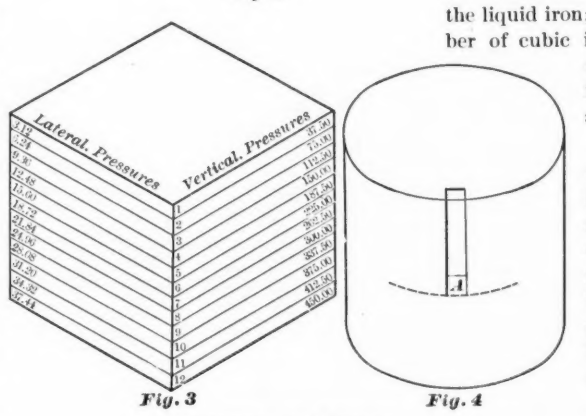


Fig. 3 Fig. 4

Pressure in Moulds.

Thus:

Side converted into a horizontal bottom	144 inches.
Multiplied by half the depth	6 inches.
Total cubic inches	864
Weight of one cubic inch	.26
	5184
	1728
Total weight in pounds	224.64

Giving exactly the same results as previously shown. (I would say just here that this rule is absolute, and applies in all cases, whether the mould be solid, like the one we are discussing, or only ¼ inch thick; as long as the iron is in a fluid state the conditions are the same.)

From these examples the following rule is deduced for calculating lateral pressure, where the mould has a flat bottom and perpendicular sides, and is simply filled open, as at Fig. 3. Find the number of square inches in one side below the upper surface of the iron in the mould, multiply this sum by the number of inches in half the depth of the liquid iron; the product will be the number of cubic inches contained in half the depth, the weight of which is equal to the lateral pressure on that side.

It matters not what form of bottom the mould may have. If it be horizontal and flat, and the sides perpendicular, the lateral pressure may be found by this rule, because the point of average pressure is always found at half the depth below the surface of the liquid iron.

Suppose the mould to be cylindrical (as seen at Fig. 4), 12 inches diameter and 12 inches deep. The point of average pressure is at *A*, which is one-half its depth. To find the pressure on the whole side of such a mould, we proceed as per rule. Thus:

Circumference	37.69 inches.
Multiplied by the depth	12 inches.
Total surface in sq. in.	452.28
Half depth in inches	6
	2713.68
Weight of a cubic inch.	.26
	1628208
	542736
Weight in pounds	705.5568

It is seen that, according to the rule quoted, we have a pressure equal to 705½ pounds on the whole side of a cylindrical mould, 12 inches diameter and 12 inches deep, when such a mould is filled with molten iron.

To prove the accuracy of this rule, we will multiply the average pressure of one square inch down the perpendicular side into the total surface previously found. Thus:

Total surface in sq. in.	452.28
Average pressure of 1 in. 12 in. deep	1.56
	271368
	226140
	45228
Total pressure in pounds	705.5568

This proves the lateral pressure to be the same as would be produced upon the bottom of a mould 452¼ inches in magnitude, with perpendicular sides, and holding liquid iron to the depth of 6 inches.

A thorough knowledge of the increase of pressure in proportion to the depth will suggest the expediency of a corresponding increase of strength in the material used for constructing very deep moulds. The pressure at the top being inconsiderable, very little strength is needed to resist it; but as the ratio of pressure increases with the depth, a good margin of strength is indispensable at the bottom. This will admit of a gradual decrease as the upper surface is neared. It is entirely owing to ignorance upon this subject that so many failures are made through lack of strength in the arrangements for securing moulds of considerable magnitude, or else, as is too frequently the case, the opposite extreme occurs, and time and material are lavished upon an undertaking sufficient for a piece of work of ten times the bulk.

Combination Slotting, Milling and Drilling Machine.

This machine is designed to cover a variety of special work at one setting, which otherwise would require several, under a drilling, slotting and milling machine. It has special features for working out cutter heads, where exact angles and distances from centers are required; also for working out dies from solid steel, etc.

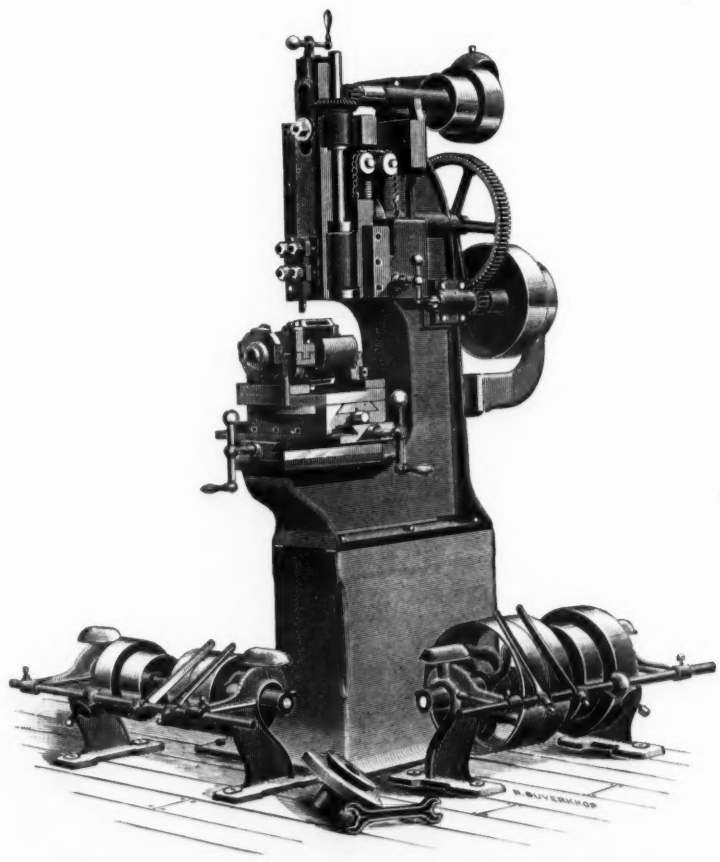
The operator can bring the work under the spindle and drill holes for slotter tools, then by a quick-motion screw the work is placed under the slotter. Then, after removing the stock, the work is again brought under the spindle, where, with mills adapted to the purpose, and proper appliances, almost any desired job in die making can be accomplished. Aside from special work it is designed for gear work up to 20 inches diameter.

The traverse of top table of the machine is 10 inches, and the traverse of the lower part is 7 inches.

The slotter has 4 inches stroke, and the spindle a traverse of 5 inches; each is operated by independent countershaft.

The spindle is geared two to one.

The manufacturer is W. H. Warren, Boston, Mass.



Combination Slotting, Drilling and Milling Machine.

We recently referred to the agitation going on against the bob-tail car. Since then a citizen of New York has essayed to make a test case, by refusing to deposit his fare, holding that a conductor must come for it. The citizen was imprisoned for presuming to object to the dictum of the railroad company, but he proposes to make a test case of it, in which the public will wish him success.

Mr. Sharpe, of the Brown & Sharpe Mfg. Co., called upon us recently, and gives a cheering report of his establishment regarding present business and prospects. The extent of their export business is very gratifying, Mr. Sharpe stating that within the two years last past they had sold to the French Government alone, nearly two hundred machines.

The largest piece of ordnance yet spoken of is the tube for conveying natural gas from Murraysville to Pittsburgh. This pipe is fourteen miles long, and occasionally a gum ball is forced through it by the pressure of the gas, the object being to clean the pipe.

Practical Drawing.

By J. G. A. Meyer.

FIFTY-SIXTH PAPER.

Problem 70.

480. *To find the intersections of the surfaces of two right cylinders* their axes lying in one plane.*

Fig. 361. Let $c\ c_3\ e\ e_3$ be the vertical projection of a cylinder, whose axis is perpendicular to the horizontal plane of projection; also let $g\ g_3\ h\ h_3$ be the vertical projection of a cylinder smaller than the former. This small cylinder is passed through the larger one; it is required to find the intersection of their surfaces. Let $A\ B$ be the ground line.

To find the curves in which these cylindrical surfaces intersect each other, we shall need a plan (or horizontal projection) as shown in Fig. 363, and also a side elevation, as shown in Fig. 362. Hence, draw these two projections, taking care to locate in Fig. 363 the center x, from which the circle $c_2\ d_2\ e_2\ f_2$ is to be described on the center line $d\ d_2$; that is, on the prolongation of the center line $d\ d_3$; and also locate the center y, Fig. 362, on the center line $i\ i_{11}$, that is, the prolongation of the center line $i\ i_3$. The distances between these projections or different views makes no difference in the construction, but the closer Figs. 362 and 363 are to Fig. 361, the more convenient it will be to find the points in the required curves of intersection. In Fig. 363 the circle $c_2\ d_2\ e_2\ f_2$ represents a plan of the large cylinder; and the rectangle $i_2\ i_4\ j_2\ j_4$ represents a plan of the small cylinder; again, because the axes of the two cylinders lie in the same plane, the center line $g_2\ g_4$ of the small cylinder must pass through the center x of the large cylinder, cutting the circumference $c_2\ d_2\ e_2\ f_2$ in the points c_2 and e_2. Of course if this horizontal projection is correctly drawn, the point c_2 and the line $c\ c_3$ (Fig. 361) will lie in one and the same vertical line; also the point e_2 and the line $e\ e_3$ will lie in another vertical line.

In Fig. 362 the circle $g_{11}\ h_{11}\ i_{11}\ j_{11}$ represents an end view of the small cylinder; and the rectangle $f_{11}\ f_{13}\ d_{11}\ d_{13}$ represents a view of the large cylinder. Here again, because the axes of both cylinders lie in one plane, the center y in the end of the small cylinder must lie in the center line $c_{11}\ c_{13}$ of the large cylinder. The center line $c_{11}\ c_{13}$ cuts the circumference $g_{11}\ h_{11}\ i_{11}\ j_{11}$ in the points g_{11} and h_{11}; if correctly drawn, the point g_{11} and the line $g\ g_3$, (Fig. 361) will lie in one and the same horizontal line; also the point h_{11} and the line $h\ h_3$ will lie in another horizontal line.

Now, in order to determine the curves in which the cylindrical surfaces intersect, we first find points in these intersections, and then the line drawn through these points will be the required curves of intersections.

In the first place, the point c_5 (Fig. 361), in which the line $g\ g_3$ cuts the line $c\ c_3$, and also the point h_5 in which the line $h\ h_3$ cuts the line $c\ c_3$, are points (in fact, the extreme points in a vertical direction,) in the curve of intersection on the right-hand side of the center line $d\ d_3$. To find other points in the same curve of intersection, we proceed as follows:

Fig. 362. Divide the semi-circumference $g_{11}\ i_{11}\ h_{11}$ into any number of equal parts, say eight. Through the points of division p_{22}, p_{23}, p_{24}, etc., draw horizontal lines p_{22}, p, $p_{23}\ p_5$, $p_{24}\ p_9$, etc. Through the same points of division also draw the vertical lines $c_{14}\ c_{15}$, $c_{16}\ c_{17}$ and $c_{18}\ c_{19}$, cutting the upper base $f_{11}\ d_{11}$ of the large cylinder in the points c_{14}, c_{16}, c_{18}. In Fig. 363, lay off on the line $i_2\ j_2$ the points p_2, p_6, p_{10}; the distance between the points g_2 and p_2 must be equal to the distance between points $c_{11}\ c_{14}$ in Fig. 362; the distance between g_2 and p_6 equal to $c_{11}\ c_{16}$, and that between g_2 and p_{10} equal to $c_{11}\ c_{18}$. Through the point p_2 draw a horizontal line cutting the circumference $c_2\ d_2\ e_2\ f_2$ in the points 4 and 10; also through the points p_6 and p_{10} draw horizontal lines, the former cutting the same circumference in the points 6 and 12, and the line through p_{10} cutting the circumference in the points 8 and 14.

* For the definition of "right cylinder," see Art. 399.

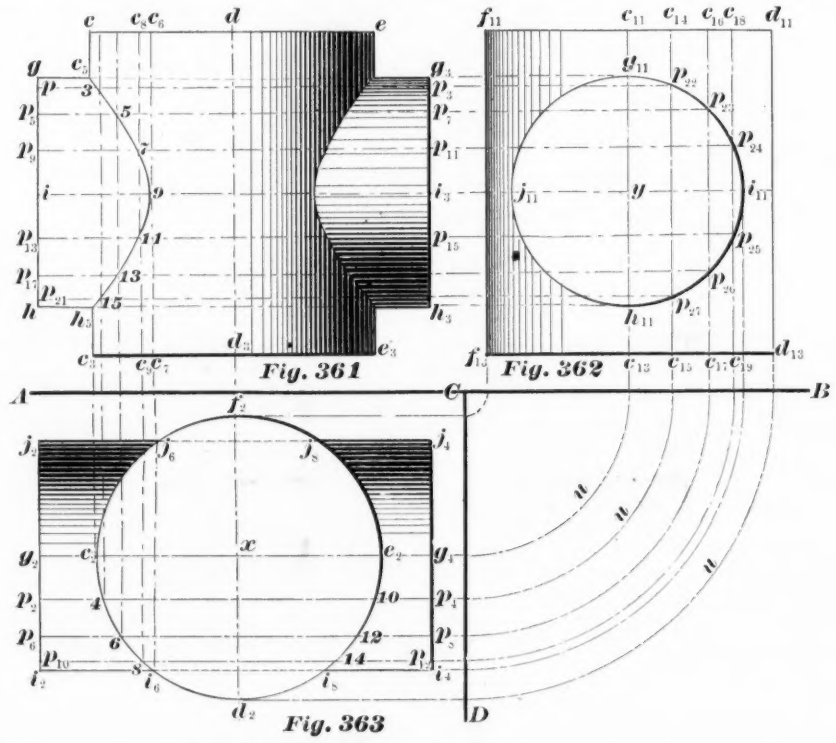
Through the point 4 draw a vertical line, cutting the horizontal lines through p and p_{21} (Fig. 361), in the points 3 and 15 respectively; also, through the point 6 draw a vertical line, cutting the horizontal lines through p_5 and p_{17} in the points 5 and 13; again through the point 8 draw a vertical line, cutting the horizontal lines through p_9 and p_{13} in the points 7 and 11; lastly, through the point i_6 (in which the element $i_2\ i_4$ of the small cylinder cuts the circumference $c_2\ d_2\ e_2\ f_2$), draw a vertical line cutting the center line $i\ i_3$ in the point 9. Through the points c_5, 3, 5, 7, 9, 11, 13, 15 and h_5 draw a curve; this curve will be the intersection of the cylindrical surfaces on the left-hand side of the center line $d\ d_3$. The curve of intersection on the right-hand side is equal to the curve just found, and can be determined in precisely the same manner.

481. Now let us examine some of the principles involved in this problem.

The principles upon which the solution of our problem is based are the same as those involved in Problem 59; the student will do well, in referring to this problem, also to Art. 423, to compare the construction given in Figs. 309, 310, with the construction given in the figures now before us. In order to find points in the intersections of the cylindrical surfaces we employ, as before, cutting planes, and pass these through the cylinders in such a manner that the cutting planes will intersect the cylindrical surfaces in straight lines. (See Art. 423.) Thus, assume that a cutting plane perpendicular to the horizontal plane of projection and tangent to the small cylinder is passed through the large cylinder. Such a cutting plane will be represented in Fig. 363 by the line $i_2\ i_4$. Now, we know that the axis of the large cylinder is perpendicular to the horizontal plane of projection, consequently the cutting plane, which is also perpendicular to the horizontal plane of projection, and represented by the line $i_2\ i_4$, is parallel to the axis of the large cylinder, and therefore the cutting plane will intersect the surface of the large cylinder in two of its elements; or, in other words, intersect the surface of the large cylinder in two straight lines. (See Art. 405.) One of these elements is represented in Fig. 361 by the line $c_6\ c_7$; the other element is not shown, but can readily be found by drawing a vertical line through the point i_6; this vertical line will contain the element. For the sake of brevity we shall confine our attention to the left-hand sides of Figs. 361 and 363. Our cutting plane is tangent to the small cylindrical surface, and, therefore, according to Art. 301, the cutting plane must touch the small cylindrical surface in one of its elements, and this element is represented by the line $i_2\ i_4$ in Fig. 363, and also by the line $i\ i_3$ in Fig. 361. Hence we say that the cutting plane contains the line ($i_2\ i_4$, $i\ i_3$.) Again, this cutting plane also contains the line $c_6\ c_7$, shown in Fig. 361; consequently the point 9, in which the line $i\ i_3$ intersects the line $c_6\ c_7$; must be a point in the curve of intersection. Furthermore, the point 9 is closer to the center line $d\ d_3$ (Fig. 361) than any other point in the curve of intersection, because any other cutting plane, which is not tangent to the small cylinder, but intersects both cylinders, such a cutting plane will intersect the surface of the large cylinder in elements at a greater distance from the center line $d\ d_3$ than the distance between the lines $c_6\ c_7$ and $d\ d_3$, and consequently the points in the curve of intersection which lie in such a cutting plane must also be at a greater distance from $d\ d_3$ than the distance between the $d\ d_3$ and the point 9. On the other hand, if a cutting plane is not tangent to the small cylinder, and neither intersects it, the cutting plane cannot contain an element of the small cylindrical surface, and therefore cannot contain a point of the curve in which the two cylindrical surfaces intersect each other.

Again, assume that another cutting plane is passed through the axis of the cylinders. This cutting plane will be represented in Fig. 363 by the line $g_2\ g_4$, and will intersect the large cylindrical surface in the elements $e\ e_3$ and $e\ e_3$, shown in Fig. 361; it will also intersect the small cylindrical surface in the elements $g\ g_3$ and $h\ h_3$, shown in the same figure. Consequently this second cutting plane contains the elements $c\ c_3$, $e\ e_3$, $g\ g_3$ and $h\ h_3$; and the point c_5, in which the element $g\ g_3$ cuts the element $c\ c_3$, and also the point h_5, in which the element $h\ h_3$ cuts $c\ c_3$, will be points in the curve of intersection. And, furthermore, these points c_5, h_5 limit that portion of the curve of intersection which can be seen. It will be noticed that so far we have had no use for the elevation shown in Fig. 362. But it will now be seen that in order to find intermediate points in the curve of intersection, the elevation shown in Fig. 362, or at least an end view of the small cylinder, will be necessary.

We may assume that the lines $c_{14}\ c_{15}$, $c_{16}\ c_{17}$, $c_{18}\ c_{19}$, in Fig. 362, represent cutting planes, which, when seen as represented in this figure, are perpendicular to both planes of projection, and passed through both cylinders. In what follows we will confine our attention to the cutting plane represented by the line $c_{18}\ c_{19}$. In Fig. 362 the small cylinder is represented as standing perpendicular to the vertical plane of projection; in Figs. 361 and 363 the same cylinder is represented as parallel to the vertical plane of projection. If, now, the method for obtaining the side elevation of any object, as explained in Problem 56 (Art. 399), is thoroughly understood, the student will readily perceive that the cutting plane $c_{18}\ c_{19}$, which, in Fig. 362, is seen as standing perpendicular to the vertical plane of projection, must, in Fig. 363, stand parallel to the vertical plane of projection, and is represented in the latter figure by the line $p_{10}\ p_{12}$. It may also be remarked that since the lines $p_{10}\ p_{12}$ and $c_{18}\ c_{19}$ represent one and the same cutting plane, the distance between the lines $g_2\ g_4$ and $p_{10}\ p_{12}$, in Fig. 363, must be equal to the distance between the lines $c_{11}\ c_{13}$ and $c_{18}\ c_{19}$ in Fig. 362.



In Fig. 363 we see that the line $p_{10}\ p_{12}$ cuts the circumference in the points 8 and 10; and since the cutting plane $p_{10}\ p_{12}$, and also the large cylinder, are perpendicular to the horizontal plane of projection, we conclude that the cutting plane $p_{10}\ p_{12}$ cuts the surface of the large cylinder in two elements which are represented by the points 8 and 14. Consequently, in Fig. 361, the line $c_8\ c_9$, which lies in the vertical line drawn through the point 8, will be the vertical projection of that element, which in Fig. 363 is represented by the point 8.

The cutting plane $p_{10}\ p_{12}$ also intersects the surface of the small cylinder in two elements, and both of these elements are represented in Fig. 363 by one line, namely, $p_{10}\ p_{12}$; the reason for representing both elements by one line, is, that in Fig. 363 one element is directly above the other, because the cutting plane, which is perpendicular to the horizontal projection, contains both elements. Hence it follows that the distance between these elements cannot be obtained in Fig. 363, neither can we determine this distance by anything given in Fig. 361. Therefore, in order to obtain this distance, we must refer to Fig. 362. Here it is seen that the line $c_{18}\ c_{19}$ cuts the circumference $g_{11}\ h_{11}\ i_{11}\ j_{11}$ in the points p_{24} and p_{25}, and the distance between these points is the distance between the two elements in which the cutting plane intersects the small cylindrical surface. Hence to represent these elements in Fig. 361, as we must do, we simply draw horizontal lines through the points p_{24}, p_{25}, and thus obtain, in Fig. 361, the lines $p_9\ p_{11}$ and $p_{13}\ p_{15}$, which are the vertical projection of the elements in which the cutting plane (which is represented by line $p_{10}\ p_{12}$ in Fig. 363) intersects the small cylindrical surface. Hence we say that this cutting plane contains the lines or elements $p_9\ p_{11}$, $p_{13}\ p_{15}$, and also $c_8\ c_9$; and, therefore, the point 7, in which the line $p_9\ p_{11}$ intersects the line $c_8\ c_9$, and also the point 11, in which the line $p_{13}\ p_{15}$ intersects the same line, $c_8\ c_9$ are points in the curve of intersection. Similar reasoning applies to the manner of finding the points 3, 15; 5, 13.

482. When it is necessary to make only the front elevation of the cylinders with the correct intersection of their surfaces, labor can be saved by drawing only a portion of the circle $c_2\ d_2\ e_2\ f_2$ in Fig. 363, and a portion of the circle $g_{11}\ h_{11}\ i_{11}\ j_{11}$ in Fig. 362, leaving out the remaining outlines in these figures. This will be explained in our next paper.

The arcs $u\ u$ and the line $C\ D$ are shown for the purpose of indicating the manner of obtaining the side elevation according to geometrical principles, which have been given in Art. 399.

Directions.—In the space marked 70 three views of two cylinders intersecting each other. The large cylinder is to be 12 inches in diameter and 15 inches high; the small cylinder is to be 10 inches diameter and 17 inches long. Then find, in the vertical projection, the curves in which the cylindrical surfaces intersect. Use 1½ inch scale.

Some interesting figures in regard to salaries have been elicited in a suit brought in Brooklyn against a baking powder company. It was shown that the president of the company draws a salary of $50,000 a year, the vice-president $30,000 and the treasurer $5,000. The president of a varnish company, who was introduced as an expert in regard to salaries, stated that the superintendent of his company received $50,000 a year, while the yearly business did not exceed $3,000,000.

Another witness stated that in companies in which he was acquainted the chief executive officers received from $5,000 to $50,000 a year, while a representative of a kerosene oil company said that he knew one officer of a large corporation who received a salary of $30,000 a year and two others who received $20,000 each.

These figures are enormous, and were unknown until the days of trusts and combinations. The explanation is furnished in the testimony of one witness, who said that the business of the company with which he is connected has been increased until the profits had reached 450 per cent. on the original capital stock.—*Commercial Bulletin.*

Exhaust Head—Improved Receiver and Separator.

One of the cuts presented with this shows an improvement in exhaust heads. The steam enters at the bottom and strikes the cone, when it is driven off to the sides around the spiral threads, the least area between the threads being equal to the area of the exhaust pipe. The spiral course taken by the steam causes the water to be thrown off by centrifugal force, allowing the steam to pass upward; then it passes out through the holes in the outside pipe at right angles and downward to the bottom of the central pipe, and upwards to atmosphere. The water thrown out to the walls of head is carried down in crevices, formed by corrugated pipe on the sides of the head, to the recess in the bottom, where it is carried off by suitable drip pipe.

The object of this apparatus is to provide against throwing water or grease on the sidewalks, and to prevent dampness on the roofs of houses.

The other cut shows an improvement in separator, better known as receiver. The object in using this apparatus is to separate the water that is carried over from the boiler and the impurities contained therein, giving the engine dry steam, and leaving the oil free to do its work on the surfaces. It is particularly useful on long steam pipes, as the water of condensation can be drawn off just before the steam is used, whether it be in a radiator or steam engine. When applied to steam engine it is placed as near the engine as possible, and can be hung in the steam pipe or placed in any convenient locality near the engine.

By reference to the cut it will be seen that the steam enters at top at *B*, and takes a spiral course between the threads of the screw, the area of the passage being a little greater than the area of the steam pipe. Thus the steam travels at a high velocity, and the water, by centrifugal force, is thrown to the outer walls, while the steam passes to holes in central pipe, and up this pipe to the engine. As it is necessary to have a given volume of space per horse-power in the receiver, an important benefit to the boiler is the result, allowing the steam to flow more evenly than if it passed through pipes direct to engine. Also the danger of knocking out a cylinder head from the presence of water is avoided.

There is an automatic float trap in the bottom of the receiver, for discharging water of condensation, and an outside lever *C*, to move valve and keep it in working order; this lever will at all times indicate the position and movement of float. This device is recommended for foaming boilers, and when large quantities of steam are drawn out, or with fluctuating load, etc.

Both the devices described are made by the Keystone Engine Works, Fifth and Buttonwood streets, Philadelphia, Pa.

The use of oil for stilling the "troubled waters" is very old. But new means of distributing the oil to the end in view are constantly springing up. Recently a German has devised a plan for doing this, which plan consists in attaching the can of oil to a rocket, then by firing it in the desired direction the end is accomplished.

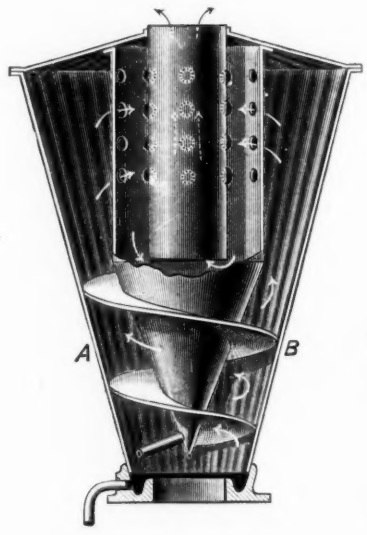
We notice that the plan of using a marine brake, to stop vessels in an emergency, is by no means abandoned. The latest effort in this direction is in the way of a cable with canvas cones attached. These open out upon occasion, and so afford resistance. It is said that a steamer on the Seine, running at a speed of 13 knots, was stopped in 7 seconds, while 34 seconds were required when the engine was reversed to stop.

English Locomotive Practice.

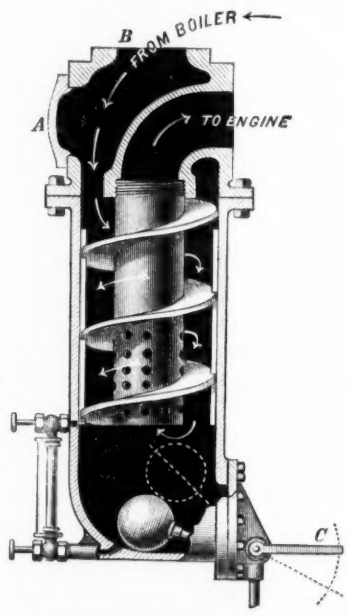
By W. H. Booth.

One of the most noticeable facts connected with American railroads, to an engineer first traveling upon them, is the quickness with which the American locomotive gets away with its load and attains its full speed. On the contrary, an American engineer first arriving in England will be struck by the comparatively slow motion and general tardiness at starting, and by the long distance traveled before full speed is attained. When speed is attained, however, it is considerably higher than the speeds attained in America, and there are in England a far greater number of fast trains than we possess. Indeed, railroad traveling is very expeditious, and seems to be conducted with a view to the public convenience rather than to shareholders' profits.

A fast train in England is usually understood to be one which makes an average speed, including stoppages, of over 40 miles per hour, and some idea may be gained of the extent of this description of traffic when it is considered that more than forty such trains daily run between Manchester and London, and some thirty trains daily between Liverpool and London also exceed a 40 miles speed. Fifty-five trains daily run between Manchester and Liverpool at considerably over a 40 miles schedule, maintaining a speed of 60 miles when running, some of them doing the 34 miles in 40 minutes, and almost invariably arriving a little before time. Hundreds of trains run simply to save local traffic, and do their 10¼ miles between important towns in 17 minutes from start to stop, and over the busiest roads. The fastest English trains run the 400 miles from London to Edinburgh in 8½ hours, and stop about half an hour on the road. These trains are run with engines having a single pair of 8-feet drivers.



Exhaust Head.



Receiver and Separator.

Now it is on this point of diameter of driving wheels that the real difference between English and American engines is found. In respect to boilers, cylinder sizes, leading trucks, etc., the two locomotives present no real differences. The bar and plate frames are after all but a matter of detail, and beyond the narrowing of the fire-boxes entailed by the unreduced bar frame, they do not seriously modify a locomotive. Every day the general appearance and the details of construction of the two locomotives more nearly coincide, but American engineers have so far almost wholly avoided single drivers and large wheels. We cannot see why this should be the case. If single drivers will work a heavy traffic in the moist climate of England, there is no reason why they should not be equally efficient in America. Any difficulty in starting is got over by a proper application of sand, and it is an acknowledged fact that when once running at speed the adhesion of a single engine is equal to the cylinder power. Hence coupling rods are only really of service in starting. English coupled engines are just about the same weight as American, and yet single engines do the same work as coupled. Why then would not an American single engine do equal work with an American coupled engine? Most probably it would if tried.

Then again in regard to speed; at high speeds the rate of revolution of the ordinary American locomotives is very high, and the effect of non-balance of moving parts is severe. With large wheels this is greatly reduced.

There has been recently in the columns of *Engineering*, a long discussion on the comparative merits of English and American locomotives. No good came of the discussion, for the majority of the writers on both sides simply busied themselves with the question of detail, such as the material of the fire-box, the frames, etc., the use of cast-iron or wrought-iron for wheels, and so on, whilst they overlooked the important question of wheel diameter.

Now, since the first of July the whole of the fast traffic in England has been much accelerated, and whilst speeds in America were being gradually approximated to those of England, they are now very far behind again, and yet the increased English speeds are attained by the same engines as hitherto used, no new types having been constructed for the purpose. Indeed, for some time past a few select runs such as Manchester and London, 203½ miles have been made in 4¼ hours, so proving the capacity of the locomotives to do the same work all over the country.

For general traffic the standard American engine is perfectly suitable, for it gets away with its train more promptly than an English engine; but for the high speeds which ought to be attained between large cities, I believe I am not alone in thinking that wheels of large diameter should be tried. Facts are very stubborn things, and the fact is obvious that the highest speeds in the world are only performed by large wheels.

It will be argued that, as tractive force diminishes with increase of wheel diameters, so will it be impossible to run such heavy trains as now are run. The English fast trains are by no means light, though they are not so hampered by sleepers and dining cars, it being customary to stop for dinner some twenty or twenty-five minutes, and sleepers being scarcely necessary. It is an old axiom that facilities for traveling cause traveling, and the English companies appear to work up to this. American roads seem rather to aim at giving in one train as much as possible, even at the sacrifice of speed, which in a large country, should at least be as valuable as in a small country like England.

American locomotive men should consider the question if they would secure high speeds, but travelers who demand high speeds should also learn, as English travelers have learned, that high speed trains should not be looked upon as traveling hotels, but as a means of conveyance rapidly from one point to another. The Englishman, is content to spend four hours in a comfortable seat, deprived of the power of locomotion, in order to travel 200 miles, which it takes the American six hours to accomplish, during which he can, if he choose, walk about or dine.

Dining and sleeping cars are common enough in England, but do not run on the fastest trains. The Manchester dining car train runs in 4½ hours what the fastest train does in 4¼. Again, the sleeper train to Edinburgh from London consumes 9½ hours nearly, against the 8½ by the day express. One cannot both eat one's cake and have it.

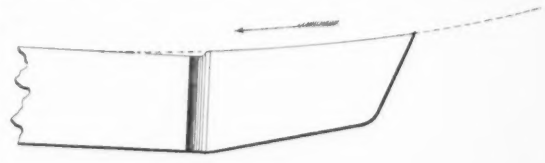
LETTERS FROM PRACTICAL MEN.

That Cutting Tool Again.

Editor American Machinist:

The Richards and Richardson family is largely represented in the machine shop. Its members are apt to have opinions and are usually free in expressing them. "Another Richards" fairly keeps up the family trait of being often in the wrong. It is not fair to say that "those who use strong language are apt to be unduly prejudiced." Those who are unduly prejudiced are apt to use strong language; but strong language may be used for other purposes than the expression of inordinate and unjust opinion. I acknowledge with humiliation that I have been unable to invent or discover language strong enough to condemn and prevent vicious practices in tool grinding. If strong language would prevent a man from so grinding his tools that they would continually do bad work and little of it, and must visit the tool dresser four times as often as they should, I would be willing to exhaust the resources of Shakespeare and Webster.

The tool sketched by "Another Richards," July 28, will work just as well as my own; but, my dear sir, you won't grind it so. The sketch being about half size, to grind the top as you have drawn it, you would need an emery wheel about 3″ diameter. You couldn't and you wouldn't grind it so on a common grindstone. The corner of the stone would make a lumpy and irregular curve at the best, and after one or two re-grindings you would be wallowing in the depths of machine shop vice with the rest. It is difficult to grind any kind of a decent circular groove with the corner of the stone, and the repeated trials required to get a shape at all satisfactory, grind away much more of the tool than is necessary merely to remove the wear. I may say generally that in this tool, or in any tool, it is an incorrect practice to grind crosswise. The grinding should always be in the direction of the flow of the chip; and so I do not care to defend my former sketch, although the top of it could be ground pretty well upon a flat-faced emery wheel. Here is a better style, and



one which in practice I would be more likely to follow. When this tool was first made I would grind it clean on top like this, and then as it wore I would regrind it only at the front.

If "Another Richards" would tell us how he would grind the tool he sketches, and give us faithful historical sketches of its successive re-grindings, and show the effects of his practice as followed by his associates, it would be of interest to many readers.

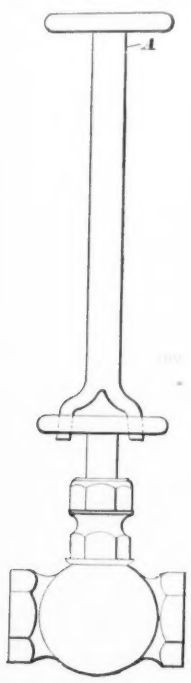
Frank H. Richards.

In Line With the Screw-Driver Question.

Editor American Machinist.

In your "Answers to Correspondents" I notice the old question, "Is there more power in a long screw-driver than a short one?" Of course the answer is always "No, if the screw-driver is held perfectly straight."

When there is a valve under the floor, or overhead, it is the practice of the writer to put on a long stem like that shown in cut, so as to bring everything handy. To have everything work proper, a plumb line is used to bring the long stem in line with the stem on the valve, and this stem is held in line by a hole in the floor, or a suitable guide at *A*.



Wherever a long stem like the one described is used, I have imagined that the valve and seat showed that they have been screwed together tighter than similar valves with the ordinary short stem and the same person to manipulate them.

Changing the subject for a moment, some years ago a steel shaft, 7⅛ inches diameter, and making 32 revolutions per minute, was put in to drive a pair of rolls, and beyond them other machinery.

The length of the shaft to the rolls was about 120 feet. The first work done by this shaft was to drive these rolls, which took some 125 horse-power.

When a piece of metal was put into the rolls they would stop, and apparently the shaft would lose some three or four revolutions, when the rolls would start and go on all right.

The shaft was connected to the engine by gearing, so that that end kept moving steadily, and the shaft must have sprung or been twisted considerably to have stopped the lower end.

This action continued for some time, until other machinery was added, which kept a nearer constant strain, until now the shaft at times is doing 250 horse-power and nothing of the kind is seen.

One point that should have been observed was, did the rolls, when started, run faster, so that the shaft straightened out at work, or did this take place after the metal had passed through the rolls? Not being situated at the time so as to make observations, I am unable to say; but the thought has arisen: Is it not possible that a certain amount of force may be stored up in a body as resistance to torsion, that may be given out again after inertia is overcome, or to overcome inertia?

If this is possible, then it is not imagination that valves arranged as shown in cut are closed tighter, and by the same rule, that a long screw-driver is more powerful than a short one, even if held straight.

This is submitted, not as a conclusion of the subject, but rather to provoke thought that shall lead to a correct conclusion.

W. E. Crane.

Wash the Core Sand.

Editor American Machinist:

Some time ago we received a number of small patterns from which to make castings; several of them were very intricate, requiring some twenty-three (23) cores in a space about 5″ x 10″ x 10″, with very poor provision for venting. Our best moulders tried several times to make the castings, but with the invariable result of a "blow," and a dirty casting. This would not do at all, and after some investigation, I suggested washing the core sand until it would not discolor clean water. The result was, no tendency to "blow," and clean, perfect castings. The amount of dirt in the sand seemed very small, but it served the double purpose of producing gas and impeding its exit from the core. Of course it is very plain that the sand for difficult cores should be clean, and I wondered that I had not thought of it years before when in similar difficulties. I don't advance the idea as anything novel, but give it for the benefit of the unsophisticated chap who is in the same boat that I was.

E. J. Armstrong.

Painted Post, N. Y.

Shop Notes.

By Jarno.

No. 9.

How Gascon tested the warp, or twist, of his planer bed.

The method that I now purpose to show for testing the twist of anything, was given to one of Gascon's foremen by Prof. John E. Sweet.

First, let us have six rolls, or cylinders, of the same diameter; two inches is a convenient diameter. The rolls can be about three and a half inches long. They are shown at *a*, *b*, *c*, *d*, *e* and *f*, Fig. 1. Now let us have three equal parallels that are long enough to reach well over the width of the planer bed, as at *g*, *h*, *i*. Lastly, we want a straight-edge *O*, Figs. 1 and 2.

The rolls are placed in pairs, in the ways of the planer bed, as in Figs. 1, 2 and 3. One of the parallels is laid upon each pair of rolls, as at *A C*, Fig. 1. The straight-edge is now laid upon the parallels. Let the straight-edge lie diagonally, the ends being over the rolls *a* and *f*. It is convenient to place a piece of paper over each parallel and under the straight-edge, because by pulling upon each piece of paper we can know whether the straight-edge bears evenly upon the parallels. If the bearings are not even, pack up under the middle or the two ends, as may be needed to make the bearings even, putting an equal thickness of paper under each end. Practically, we would generally expect the middle of the straight-edge to bear the hardest, due to the sag of the straight-edge. It is a pretty good straight-edge that does not sag more than one one-thousandth of an inch in ten feet. Now take the papers from under the two ends *A* and *D*, and swing the straight-edge upon the middle *O* to the position of the dotted lines *C B*, and under the ends at *C* and *B* place the same pieces of paper that were under the ends in the position *A* to *D*. Now if the pieces of paper are held at *C* and *B*, with the same tension that they were held at *A* and *D*, the bed is not twisted at the four places *A*, *B*, *C* and *D*. If the papers are not held with equal tension the bed is twisted, and the low

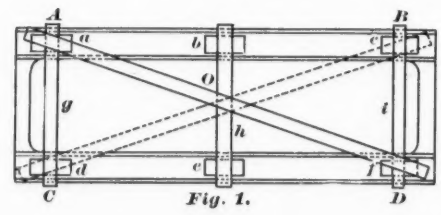


Fig. 1.

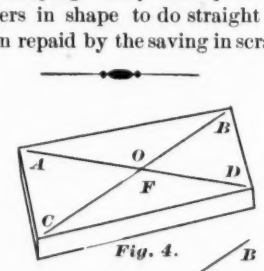


Fig. 4.

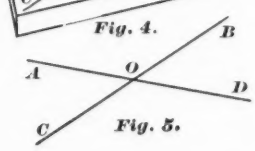


Fig. 5.

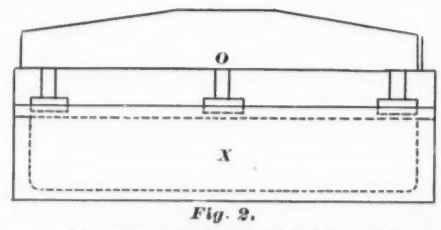


Fig. 2.

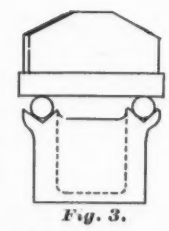


Fig. 3.

TESTING THE TWIST OF A PLANER BED.

places, or corners, must be raised. Generally a planer bed can be straightened by blocking up under the low places.

Gascon found one planer, that he had used for some years, to be so bad that he could not make its bed come straight, except by dressing the ways. Within the limits of the sag of the straight-edge we can also tell, with the tools named, whether the bed is straight. In making the test for straightness it is well to let the straight-edge rest directly upon the parallels and have it in line with the ways of the bed. If the middle parallel were loose under the straight-edge we should know that the bed was hollowing. If the end parallels *g* or *i* were loose, while *h* was tight, then the bed would be rounding.

If a planer bed be hollowing, the upper surface of planed work will be hollowing.

The principle of the test for twist can be understood from Figs. 4 and 5. Upon any flat surface *F*, Fig. 4, can be drawn two straight lines crossing each other, as *A D* and *B C*. A little consideration will show that any two straight lines *A D* and *B C*, Fig. 5, having a point *O* in common, will fit a flat surface. In the language of geometry, this would be stated thus: If two straight lines have one point in common, they will be in the same plane.

If the line *A D* be swung about *O* to the position *B C*, then will the points *A*, *B*, *C* and *D*, at the ends of the line in its two positions, be in the same plane.

Now, in Fig. 1 we have simply made a practical application of this principle, to see whether the points of the ways near *A*, *B*, *C* and *D* are in the same plane.

If we were to test only the twist of the bed we should not need a straight-edge, because the twist can be tested with any piece that can be swung about *O*, and is long enough to reach from *A* to *D*.

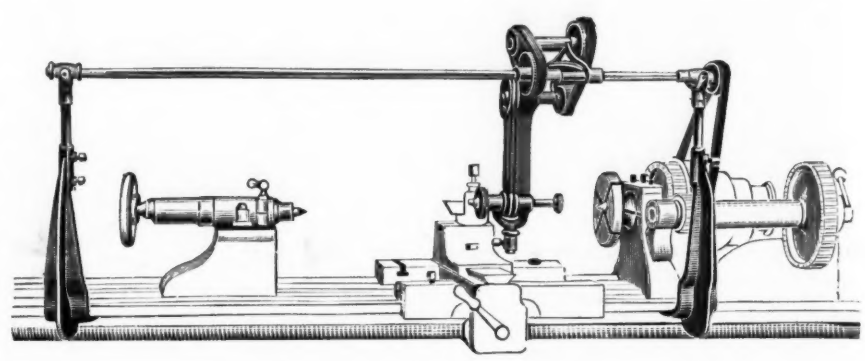
It is well to test large planer beds as often as once in six months. Though a bed rest upon masonry, it may change. The testing can be done quicker than I can tell it.

Attention to the condition of planers saves much hard work of the scraper men. When a bearing is to be made perfectly straight, an error in planing of two or three one-thousandths of an inch means several hours work in scraping. Any time spent in keeping planers in shape to do straight work is more than repaid by the saving in scraping.

Grinding Attachment for Lathes.

The accompanying illustration represents an attachment for grinding in the lathe, the nature of which, and the nature of its application, will be easily understood without extended description. As will be seen, there is a splined shaft, supported in suitable brackets, and extending along the lathe above the carriage. This shaft is driven by a 1¼″ belt, and is made long enough to enable work six feet in length to be ground. The emery or corundum wheel is driven from this shaft, the speed being increased in the manner shown. The bracket which supports the grinding spindle is held in the tool-post, and can, of course, be used on straight or taper work, the latter either by setting over the tail center or by the use of taper attachment or compound rest. Internal grinding can be done, and facing also. The attachment is heavily and substantially made for a machine of its character, and will do anything which can be done on the lathe, subject, of course, to the limitations of grinding operations.

They are manufactured by the Union Stone Co., Boston, Mass.



Grinding Attachment for Lathes.

Shop Notes.

Continuing from last week the account of the things seen among the shops of Wilmington, Del., during a recent visit there, we found the Trump Bros. Machine Co. quite busy upon their regular lines of manufacture, which include not only finished case-hardened nuts, drill chucks, center grinders, etc., by which they are best known to our readers, but knitting machines, of which they are builders upon contract with parties in Philadelphia who control the sales.

These machines are of considerable interest to a mechanic, requiring a good deal of intricate and nice workmanship in their construction. They are used for the manufacture of all kinds of knit goods, such as underwear, etc., the circle of needles which make the stitches being proportioned to the width of that particular garment or portion of a garment it is designed to make; the number of needles per inch of circumference depending upon the relative fineness of the goods to be made.

This necessitates the building of a good many different machines similar to each other in principle yet differing enough to require different sets of tools. Jigs and special fixtures are used for building them, their jigs and milling fixtures being very well designed for their purpose.

Their special fixtures for finishing nuts are very efficient, especially those for facing and milling the sides. The nuts come to them in the rough state, except that they are tapped out; they re-tap them, and for milling the sides have discarded the long slender arbors usually employed for the purpose, which they consider spring too much under the cut to secure true work, and have substituted for it a fixture which holds but two nuts upon short studs, and they are then straddle-milled two at a time, using four cutters, the fixture being used upon a slabbing machine. By this means the nuts turned out are of very superior quality as regards truth and accuracy.

At the works of the J. Morton Poole Co., makers of the famous Morton Poole roll grinding machines, business is quite good; they are just completing an addition to their foundry, and have also recently put in a new swinging steam crane, built by Wm. Sellers & Co. It is a 30-ton crane, covering a circle 54 feet in diameter, and was put in with special reference to quick work in connection with some large castings they have to make for beating engines for paper mills—machines they are building quite a number of just now. The frames of these engines consist essentially of a large tank of cast-iron, having a peculiar shape, and with the sides and bottom about one inch thick. They are moulded in pits dug in the foundry floor, and it is for setting the cores, and other work in connection with this job, that the crane is principally used. Its quick action is required especially in lifting the cores after the casting is poured, as, if left in too long, no room is allowed for shrinkage, and a cracked casting is the result. The crane seems to work very well, and to be under perfect control. Two small upright engines, mounted upon the crane, furish the motive power. They are

coupled together, "quartering," to avoid dead center, and their speed is controlled from the ground by the operator. For hoisting there are two speeds relative to the engine, either of which is thrown in at will by means of friction clutches. The hand levers for manipulating the crane are brought close together, are quite small, and require only a comparatively slight movement to effect the various motions. All the gearing is cut, and the crane works very quietly, and, when required, very rapidly.

They are making a good many chilled rolls for various purposes, some of them ground to a beautiful finish on their grinding machines, others grooved in various styles for the roller mill process of flour making. For grinding new rolls and others sent in to be re-ground, they have in use ten grinding machines, not all of them, however, constructed upon the principle of the well-known Morton Poole machine (illustrated in the AMERICAN MACHINIST, of July 3, 1886), some of them being made to use only one grinding wheel, which is mounted upon a carriage, part of which takes the form of a large split sleeve, which is bored out to fit, and slides upon a large chilled cylinder, which was ground true upon the regular machine. This cylinder and the roll to be ground are level with each other, provision being made for adjusting the roll so that its axis shall be precisely parallel to that of the cylinder.

Beneath the side of the carriage which carries the wheel is a steel bar, ground straight, and set parallel to the cylinder, and upon the upper edge of this bar the carriage rests, thus being free to be guided by the ground cylinder alone. Mr. Poole states that they get excellent results from these machines, the wear upon the chilled cylinder being inappreciable, though, of course, it is evident they do not possess the feature of being independent of wear, as the others do. Rolls made by this company are coming into use for cold-rolling sheet copper, used for certain purposes, where a very nice surface is desired.

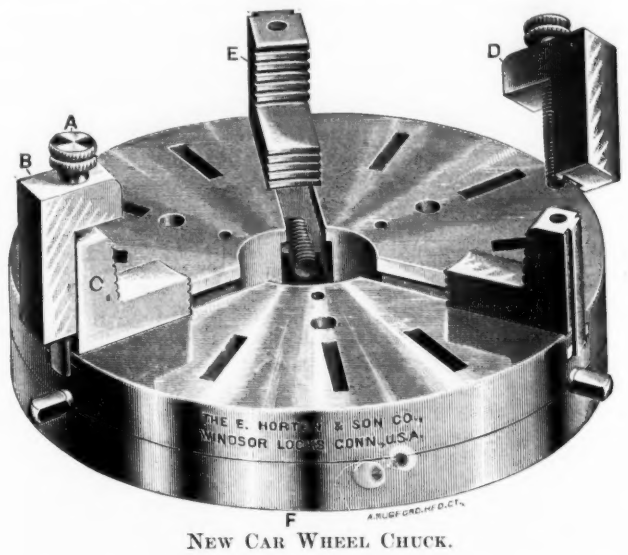
For cutting the spiral grooves upon chilled rolls used for flour making, they use a very efficient machine, built for them by the Betts Machine Company. It resembles a planer, but the bed is moved more slowly than that of a planer, and by means of a screw, instead of gears. A heavy pair of centers are mounted upon the bed, and upon the outer end of the spindle of one of these centers is a heavy worm-wheel, which takes the place of the index plate usually mounted there. Beneath the worm-wheel is a slide extending across the bed, upon which is journaled a screw, which engages the teeth of the worm-wheel. The screw extends out over the edge of the bed next the operator, and on this end is mounted a crank and an index plate. If the screw be turned by the crank, it acts as a worm, and the roll which is between the centers is rotated; and if the cross-slide carrying the screw be moved across the bed, the screw acts as a rack and the roll is also rotated. The end of the slide opposite the operator is extended out over the bed, and is connected by a sliding block with a guide bar, which can be set at any desired angle with the bed, in the same manner as the Slate taper attachment; thus, as the bed moves along, the cross slide carrying the screw is moved across the bed, and the screw, not turning, but acting simply as a rack, turns the worm-wheel and gives the proper spiral motion to the roll; and, during the back stroke, the operator, by means of the crank and index plate, having the usual counters, turns the roll the right distance for the succeeding cut. Broad tools are used, the ends of which conform to the periphery of the roll, and have teeth milled in them the proper pitch for the grooves; some of these teeth are partly cut away, so that they cut only a part of the depth, while the succeeding ones cut the full depth, and finish the groove. The number of grooves which can be finished at one movement of the roll under the tool, depending upon the number of grooves to the inch. On the finer ones (having about 8 or 10 grooves per inch), four of them are begun and four finished at each movement.

At the shops of the Remington Machine Company, and the Hall Steam Pump Company, which are in adjacent buildings and under the same management, they are also quite busy, and for some time past have been running both shops until 10 P. M.

The former company have built several Corliss engines, and now have the contract to build a large one for the Harlan & Hollingsworth Co.

Among the other machines now in process of construction, is one for making cold rolled iron by a new process. This machine, instead of using grooved rolls, uses rolls which are plain round cylinders, except for two flat places, opposite each other upon each roll, for feeding, as hereafter to be explained.

These rolls are not placed one above the other, as is usually the case, but are side by side in the machine, and instead of revolving in opposite directions, as ordinary rolls do, they both revolve in the same direction, and the iron, after having the scale removed, is passed in between them, parallel with their axes, and revolves between them, the same as an intermediate friction gear would. The ends of the rolls, next the side from which the iron is to be fed in, are tapered for a few inches, and, as mentioned above, there are two flat places upon each roll, which, when they come round together (which, of course, occurs at each half revolution), allow the iron to be fed in. The feeding is done automatically by suitable gearing. The frame, and, in fact, the whole construction of the machine, is very massive, the distance between the rolls being adjustable by means of powerful screws and gears, and it is expected that shafting can be made by this means very accurate as to size, true and straight. There are suitable rests provided above and below the iron, to keep it in place while being rolled, though it is not expected that much force will be required to do this.



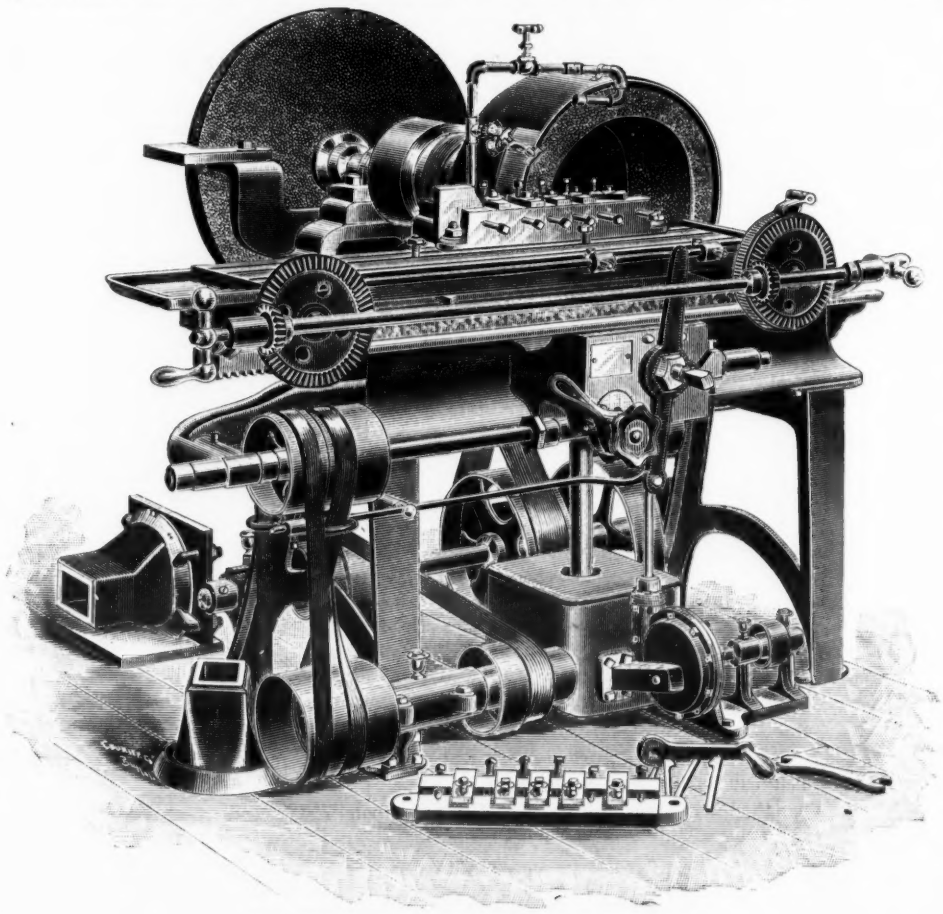
NEW CAR WHEEL CHUCK.

New Car Wheel Chuck.

The engraving herewith represents a new 42-inch chuck for holding car wheels and car wheel tires in a lathe or boring mill. It was designed by Mr. E. B. Bailey, the general manager of the E. Horton & Son Co., Windsor Locks, Conn., which company is putting it on the market. In the engraving, *F* is an ordinary Horton chuck body, except that it is heavier and stronger; *C* represents the permanent jaws slotted, and locked their whole length into the body; the bite of the jaws are made upon a suitable angle to fit the tread of wheel, as in the common Horton car wheel chuck. *B* represents a clamp jaw attached to the permanent jaw, in the manner shown in the cut, and is operated by the carrying screws *A*.

The object of the clamp jaw is to hold the wheel or tire more solidly, and to prevent its being lifted out of the chuck, wholly or in part, while being bored or turned, thus insuring its being held accurately. This chuck, being self-centering, will be particularly useful in holding tires for paper car wheels, while being made, as well as doing ordinary car wheel work, for which a chuck is required.

The company will furnish this chuck either with or without the clamp jaws; in the latter case, it makes a first-class chuck for general work where an extra heavy universal chuck is wanted.



CUP WHEEL AUTOMATIC VARIETY GRINDER.

Cup Wheel Automatic Variety Grinder.

This machine is designed for grinding flat surfaces of moderate width, such as steel dies of great variety, keys, flats used in card grinding machinery, iron planes and any article with straight edge or flat face.

The grinding is done on a front edge or rim of the cup wheel which grinds the work flat and true. It has a three T slotted table 9 inches wide, on which chucks, angle irons and various arrangements can be placed, adapting it to do a large variety of work.

Both ends of the table are advanced or fed forward equally at the same time by means of bevel gears and connecting rod. The carriage runs on a dovetail track of good width, gibbed to take up wear, and can be instantly stopped by dropping the worm out of gear without shipping any belts or stopping the wheel, a convenience in putting on and taking off work. The worm and worm gear are run in an oil dish to prevent wear.

The machine has galvanized iron pans on the carriage under the table; and one under the wheel that catches the water used and conducts it into a cast-iron tank located under the machine out of the way. A centrifugal pump is attached to one of these tanks, piped so that plenty of water is supplied to the wheel, with valve to regulate the amount of flow.

The pump furnishes a large supply of water, prevents heating and drawing the temper, and grinding can be done much faster than when run dry. Moreover it prevents loose emery flying on the working parts, and on the neighboring machinery.

Seven sizes of these machines are made, and can be furnished to do work from one inch to twelve feet long. A large wheel can be used on the back end of the spindle for dry grinding of miscellaneous work. It has 1¼ inch steel spindle, bearings 8 inches long, with spindle pulley 8½ x 5 inches. The emery wheel is 16 inches diameter, 8½ inches deep outside measure with 2 inch rim, and is large for a cup wheel, being equal to one 26 inches diameter by 1½ inches thick of the common kind. The emery wheel rests on a carriage running over a back extension to the bed, and is fed forward on a dovetail track, as the wheel wears away, by means of a hand screw, from the back side of the machine.

An overhead countershaft goes with each machine, with driving pulley 16 inches diameter, 10 inch face (the extra width of face to make it so the emery wheel below can be fed forward as it wears away and belt carried along accordingly). The tight and loose pulleys are 10 x 5 inches, and should run 600 revolutions per minute. This machine is made by the Springfield Glue and Emery Wheel Company, Springfield, Mass.

A German is said to have perfected a process whereby a softer quality of wood is rendered equally as good as lignum vitæ, for such purposes as stern bearings for propeller shafts. He forces oil into the pores of the soft wood, then subjects it to intense pressure, thereby solidifying it.

Mr. Wheeler, of the York Mfg. Co., York, Pa., called upon us a few days since. His establishment is engaged in general machine work, including engines, water wheels, and ice machines, and he reports business excellent, the shops having been obliged to run nights for some time past.

What is considered in England as a new rod packing has been devised. It consists of what has been tried in this country time and again, viz., of fine brass wire, properly wound, which, by its elasticity, packs the rod.

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NEW YORK, AUGUST 11, 1888.

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Fireproof Shops and Insurance.

The large majority of the manufacturers of this country are undoubtedly so situated as to make fire insurance upon their plants a business necessity. Their buildings are so constructed, and the surroundings are such as to make them constantly liable to disasters by fire, and, of course, in order to be upon a solid basis, their business must pay, as part of the legitimate expenses of carrying it on, the premiums upon this insurance. That this liability to losses by fire, and the money necessary to be paid to insure against it, forms no inconsiderable portion of the burdens laid upon manufacturing operations, no one who has taken the trouble to investigate the matter will deny. Then, besides the money paid as premiums upon insurance policies, there is a further risk which cannot be insured against, *i. e.*, the losses consequent upon interruption of business, disarrangement of plans, and the loss of the innumerable little things valuable, many of them far above their cost of production, not easily replaced, and usually not insurable, the risk of the loss of which by fire should really be counted along with the legitimate expenses of manufacturing.

There are many manufacturers who can secure themselves against this in the old way only—by paying insurance premiums, and setting aside a certain amount to cover the non-insurable risk. But when new shops are to be erected, it is advisable to consider how much insurance is going to cost if they are constructed in the ordinary way, and how far the amount of money represented by the cost of insurance, computed at the ruling rates of interest, if used in rendering the buildings secure against fire, will go toward reducing the risk to a point at which it can be safely carried by the manufacturer himself.

In the planning of quite a number of modern shops this question has been given full consideration, with the result, in many cases, that insurance has been entirely dispensed with, it being considered safe and profitable to do so.

There is no doubt that shops—especially those in which metals only are worked—can be so constructed as to reduce the risk of fire to a very small amount, if, in addition to fireproof construction, the proper management in the way of cleanliness and the employment of watchmen is maintained.

The Betts Machine Co., for instance, carry no insurance upon their plant, except upon the boilers. Their buildings are one story high, the different departments being in separate buildings, which are at a sufficient distance from each other to make it easy to prevent fire from communicating from one to the other, are substantially built of brick, with slate roofs, supported by iron trusses and iron pillars, while the floors are either of brick, or otherwise made practically fireproof. As a result, Mr. Betts, Sr., president of the company, says he hears the fire alarm turned in during the night from the box nearest his shops, and immediately goes off to sleep again, in the full confidence that he will find his shops all right in the morning. Surely this feeling of security from the disastrous effects of fire is worth considerable, aside from the pecuniary questions involved, and it is something which cannot be secured by any amount of insurance payments. Another point to be considered is that such a construction of shops as will make them practically fireproof also makes them better as shops in which to carry on manufacturing operations, aside from considerations of greater security against risk of fire.

Such shops can usually be much more easily kept clean, and iron trusses and pillars are also much better for the support of line shafting, countershafts and cranes, keeping them in line and in proper position much better than wooden posts and framing. And floors built to be fireproof are necessarily more substantial, and every way better fitted for the support of machinery and the carrying on of manufacturing operations generally, all of which should be taken into account in the question of shop building, and in favor of the fireproof construction. Where two or more floors are needed in a building, the use of iron I beams with brick arches between them costs of course considerably more than one made of wood, but we venture to say that when, to its greater security against fire, is added its increased durability, its superiority as a support for machinery above, and shafting below, to say nothing of its greater cleanliness, its deadening of noise and better appearance, it will in the end be found cheapest.

Experience has shown, however, that the best fireproof constructions cannot withstand such fires as those which visited Boston and Chicago; but where shops can be located so as to avoid the danger of being destroyed by fires originating elsewhere, it is undoubtedly possible to so construct and manage them as to make insurance almost if not quite unnecessary, and to all those who contemplate the building of new or the enlargement of old manufacturing plants, we suggest the full and careful investigation of the question of fireproof construction.

There is every indication that Congress will before long be called upon to take some action in relation to immigration. As the matter now stands, the country is flooded with the cheapest and worst kind of cheap foreign labor, and wherever this labor can be employed it crowds out the men who have some idea of living decently. A goodly proportion of the foreign laborers who find their way to this country at this time are quite unable to make bargains for themselves, and the result is they are bargained away by middlemen at the best price that is offered. They do not live as Americans, and for the most part have no idea of becoming American citizens. Such money as they may be able to save—and that comprises about all they earn—they eventually take "home" when they leave the country.

This is not protection to American workmen, and this fact is coming to be better understood every day.

Whether restricting immigration will remedy the evil is an open question. But it becomes all the time more plain that the "general invitation" extended by this country to the undesirable labor of European countries is not working satisfactorily; something should be done to check it, or to provide openings for it that do not yet exist. The wisdom of our legislators is likely, very soon, to be sorely taxed to reconcile matters in this respect.

There is rumor of extensive thieving in the Brooklyn Navy Yard. There is probably truth in the rumor. It will strike most people as strange that, where so little business is done as at any one of our navy yards, there should be much opportunity for stealing. A private concern doing double the business would not be troubled in that way. It is apparent that our navy yards and similar institutions are not managed as well as private institutions are. Is the Government above learning in this respect?

As a matter of fact, thieving in the navy yards of the country has been common for years, and it has hardly been necessary to conceal it. In this particular instance, if the practice is brought out prominently, it may have a good effect.

We have before this called attention to reckless blasting in the upper part of New York city. The city has, somewhere on its books, regulations in regard to this. But no attention is paid to them. It has become the fashion for contractors, and nearly every one else, to set the authority of the city at naught, and in their efforts to do so they are abetted by city officials. Let all obey the laws is a good motto, but it applies only to ordinary mortals. Even the highest city officials conspire to prevent the enforcement of the law in the case of great corporations and rich contractors.

Back of Jersey City is a large tract of land known as the "Meadows." This land is practically valueless, being in part covered with water. It is also a breeder of malaria and mosquitoes. There is now a proposition to fill in this land, thus reclaiming and making it valuable. The plan is to use the garbage from New York for this purpose. The land in question would be valuable if the surface were raised above high-water mark, but the undertaking is a large one.

QUESTIONS AND ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common-sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials nor location will be published.

(373) C. J., Detroit, Mich., writes: Please give me a rule for calculating the amount of water a Silsby rotary fire engine will discharge in a given time. *A.*—Write to the makers of this pump; they, through their experience with it, can give you a more reliable rule than we can.

(374) J. M. L., Cincinnati, O., asks: Do you think it is possible to paste or cement platinum to gutta percha? If so, can I buy the paste or cement? If not obtainable how can it be made? *A.*—We believe that this is possible; the recipe for the cement given in answer to Question 6, Jan. 7, 1888, may answer your purpose; we never had occasion to try it. Whether you can buy this cement ready for use, we do not know.

(375) H. D., South Bethlehem, Pa., writes: Please inform me what metals are used to give the best results in the construction of a steam whistle. *A.*—See Locomotive Brass Castings, AMERICAN MACHINIST, page 3, Oct. 29, 1887: use the metals as used for bells. This mixture, we believe, will give you good satisfaction, although it is slightly modified by some manufacturers of whistles. 2. Is there another design or pattern of the steam whistle besides the round one? *A.*—Not that we are aware of.

(376) J. A. W., Aberdeen, Miss., writes: Please let me know the difference between a flue which closely fits the hole, and one that fits loose That is to say, is there any bad effect from having to expand about one-sixteenth of an inch? *A.*—It is always best not to make the flue holes any larger than necessary for the flues, so as to reduce the amount to be expanded as much as possible; the more a flue has to be expanded the more it is liable to injury, and, besides this, a longer time for expanding will be required. The holes should be just large enough to push the flues through them, and for this purpose we believe 1-32 of an inch in diameter to be ample; less will be better.

(377) H. T., West Chester, Pa., writes: I would like to know how to find the length of a rope belt when I have the distance from center to center of shaft and size of pulleys. The two pulleys are not in the same plane, but the axis of one pulley is at right angles to the axis of the other. *A.*—A calculation of this kind will be long and tedious. We believe the approximate lengths found in the following manner will be sufficiently close for practice. Consider the pulleys to be in the same plane and find the length of the open belt required for these pulleys, by the rules given in our issue of July 14, page 4 (current vol.), also find the length of the crossed belt by the rules given in our issue of July 21. Add one-half of the difference of these lengths to the length of the open belt; the sum will be the length required.

(378) C. O. W., National City, Cal., asks: Is there any possible way to set and reset the valves of a Corliss engine to cause it to cut off at any desired point of the stroke of piston? *A.*—It cannot be done. 2. Can you tell me where to procure a full explanation of the construction of a Corliss engine? *A.*—Corliss engine, by W. A. Uhland; translated by A. Tolhausen. 3. How can a locomotive driving axle be laid off for the eccentric keys to come right in relation to the wrist-pins after the driving wheels have been pressed on axle? *A.*—The key-seats are planed in the eccentric wheels before they are put on the axle. The eccentrics are then placed in their correct position, the key-seats on the axle marked off, and then cut out by hand. The manner of finding the correct position of the eccentric has been explained in the articles on Modern Locomotive Construction, now running in the AMERICAN MACHINIST. 4. Where can one draw the line between wrist-pins and crank-pins? I say the pins in a locomotive driver are the former, while pins fitted in cranks are crank-pins. *A.*—It is a difficult matter to draw the line between wrist and crank-pins. Although the pins in the locomotive drivers are sometimes called wrist-pins, we believe that the term crank-pins is the only correct term for these pins. The term "wrist-pin" is usually applied to crosshead pins. In a general way it may be said that crank-pins have a complete motion of rotation, and wrist-pins a motion of translation or rectilinear motion. In our opinion the term "crank-pin" should be applied to pins which connect the crank and connecting-rod in any engine, locomotive or otherwise; pins in the crosshead should be called crosshead pins; and the term

"wrist-pin" should be applied to pins in other mechanism, which have rectilinear motion, or which describe arcs of circles, providing a more definite term cannot be found for them.

(379) X. Y. Z., Montreal, Canada, asks: Is the oil obtained by using a grease extractor as good for lubricating purposes as fresh oil? *A.*—We do not think it quite as good as the same quality of fresh oil, but it may be very nearly so.

(380) W. E. C., Waterbury, Conn., asks: Will you please inform me how much the work on Hydraulic Power and Hydraulic Machinery, referred to in question 358, costs? And also the publisher's name? *A.*—It is a small book, the price is $10.00. You can obtain it from D. Van Nostrand, Publisher, 23 Murray street, New York.

(381) Loco., Boston, Mass., asks: Do the reports of the Railroad Master Mechanics' meetings contain real information respecting the locomotive, or do they just contain their parliamentary proceedings? If they contain real information where can they be obtained, and what is the price? *A.*—These reports contain an account of the whole proceedings, including useful information respecting the locomotive. You may obtain the reports, and also the price, by writing to the secretary, Angus Sinclair, Chicago, Ill. 2. Please settle the dispute as to whether a locomotive can haul a heavier train with slack or close couplings. *A.*—With slack couplings the locomotive can haul over curves a heavier train than with close couplings, because with slack couplings the train has greater freedom to adjust itself to the curve of the track. Even on a straight track, a somewhat greater load can be hauled with slack couplings than with close ones. On the other hand if the couplings are too slack, the jerks which the rear cars of a train are liable to receive in starting may result in injury to the cars, or these jerks may break the couplings.

(382) G. K., New Orleans, La., writes: I wish to obtain some information in regard to the strength of metals, as for instance in the proportioning of keys, key ways in piston rods, and cast-iron crosshead and metal in front to stand shearing, crushing and tensile stress. For instance, the piston-rod is 3 inches in diameter; what should be the size of the key, and the amount of metal in front and back of key? The end of the piston-rod fitting in the crosshead is to be tapered as per sketch. *A.*—Piston-rods are subjected alternately to tensile and compressive stress, both of which must be considered in calculating the strength. Hence, we must first find the diameter which will give the piston-rod sufficient strength to resist the tensile stress; then we find the diameter which will give it sufficient strength to resist compressive stress, so that the rod will not bend or spring out of line. If we find that the diameter of the piston-rod must be, say 3 inches, to resist tensile stress, and 2⅛ inches to resist compressive stress, it must be made 3 inches in diameter. If, on the other hand, we find that for the compressive stress we need a diameter greater than that required to resist the tensile stress then the diameter of the rod must be made to suit the compressive stress. To explain these rules for finding the diameter suitable to resist tensile and compressive stress, as you wish to have them explained, will take up too much space in these columns, and we will have to refer you to the treatise on the Strength of Materials, by Thomas Box. But assuming that the length of the piston-rod in comparison to its diameter is not so great as to buckle or spring under the maximum steam pressure, you may at once find the size of key and metal around it by the rules given in the AMERICAN MACHINIST, June 25, 1887, page 4. There are given the dimensions for locomotive pistons and piston-rods, calculated for a maximum steam pressure of 120 pounds per square inch. If now the pressure in your cylinder is 120 pounds per square inch and the rod to resist this pressure must be 3 inches in diameter, as shown in your sketch, then adopt the dimensions given for a 3-inch rod in the illustrations. In these we find that the key should be 9-16 inch thick and 2⅝ inches wide at the large end. The metal in the crosshead from the key to the shoulder of the piston-rod is 1¾ inch; and the metal from the key to the end of the piston-rod is 1⅛ inch. If the pressure on the piston is less than 120 pounds per square inch, then find the diameter of the piston-rod by the rule given in the same paper, look for that diameter in the illustrations, and adopt the dimensions given for that diameter of rod.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

See Grant's Gear advt. on back page.
Link-Belting.
Send for Catalogue of Link-Belting.
Over 50,000,000 feet of Link-Belt in use.
Link Belt Machinery Co., Chicago and N. Y.

See our new designed engine lathes in Cincinnati Centennial Exposition, Lodge, Davis & Co.
See our new designed drill presses in Cincinnati Centennial Exposition, Lodge, Davis & Co.
See our new designed shapers in Cincinnati Centennial Exposition, Lodge, Davis & Co.
See our new designed brass working tools in Cincinnati Centennial Exposition, Lodge, Davis & Co.
2,000 feet of space in Cincinnati Centennial Exposition, Lodge, Davis & Co.
See special ads. pages 15 and 16. Lodge, Davis & Co.

Shafting Straighteners. J. H. Wells, Tampa, Fla.
Steel Name Stamps, etc. J. B. Roney, Lynn, Mass.
Lamb Knitting Machine Co., Chicopee, Falls Mass.
Machine work and pattern making. Anderson Machine Works, Peekskill, N. Y.
The Best Upright Hammers run by belt are made by W. P. Duncan & Co., Bellefonte, Pa.
Light articles built to order by the American Sewing Machine Co., Philadelphia, Pa.
Drop presses, punches and shears. Williams, White & Co., Moline, Ill., manufacturers.
R. Dudgeon. 24 Columbia st., New York Improved Hydraulic Jacks and Roller Tube Expanders.
Pattern and Brand Letters. Vanderburgh, Wells & Co., cor. Fulton and Dutch sts., New York.
"Swift" Sight-feed Lubricator; no glass tubes; simple, reliable. Swift Lub'r Co., Elmira, N. Y.
Davis Key-Seating Machines, kept in stock, by Manning, Maxwell & Moore, 111 Liberty st., N. Y.
"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.
Drawings, mach. patterns and models. Inventors' ideas perfected. Valentine, 15 Alling st, Newark, N.J.
Selden Packing, for stuffing-box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N.Y.
Brown & Sharpe Mfg. Co., have a line of machinery with S. A. Smith, 23 S. Canal st., Chicago, Ill.
Patents—Whittlesey & Wright, 705 8th st., N. W., Washington, D.C. Send for pamphlet and references.
Ice and Refrigerating Machines, 124 built and all successful. David Boyle, 521 Monroe st., Chicago, Ill.
For the latest improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co. 138 Jackson st., Chicago, Ill.
Engine lathes, hand lathes, fine tools, files and supplies for machinists and other metal workers Grasse & Co., 92 Park Row, N. Y.
Patent Attorney. R. G. DuBois, 916 F. st., Washington, D. C. Service at reasonable rates. Send for pamphlet containing list of references.
Machinists' supplies, brass goods, m't'rs supplies, polishing materials, all kinds wire, metals etc., in any quantity. Jordan & Gottfried, 208 Canal st., N.Y.
For Best Return Steam Traps, Pressure Regulators, Positive-Acting Pump Govs., Back-Pressure Valves. T. Kieley, 11 W. 13th st., N.Y. Send for des'n.
Fine tools and supplies for machinists and other metalworkers. Get our prices before purchasing elsewhere. Montgomery & Co., 105 Fulton st., N. Y. City.
Curtis Pressure Regulators, Curtis Return Trap, Curtis Damper Regulator. See Aug. 4, p 11. Send for circular No. 17. Curtis Reg. Co., Boston, Mass.
Upright drills, improved, sizes 21", 23", 25", 28", 32", 36" swing: finely made and great capacity; write for cuts and prices. Currier & Snyder, Worcester, Mass.
W. H. Hoffman, consulting engineer, 108 Liberty st., room 3, N. Y. Mechanical engineering in all its branches; working drawings for the transmission of power by steam, water, air and electricity.
Parties requiring milling machine or screw machine work furnished, in large or small quantities, please write to the manufacturers, E. E. Garvin & Co., 139, 141, 143 Centre st., New York City.
Contract work of all kinds executed promptly and on reasonable terms. Parties wishing gray iron castings in large quantities can make money by corresponding with Rawson Mfg. Co., Hornellsville, N. Y.
A practical treatise on the steam engine, by Arthur Rigg, essays on the principles involved in design and construction of fixed engines; 312 pages, with 96 plates. 4to, cloth, $10.00. E. & F. N. Spon, 12 Cortlandt st., N. Y.

For the manufacture of
Patented articles in line of machine work;
Specialties in fine light machinery;
Accurate cam cutting;
Address Wardwell S. M. Co., Woonsocket, R. I.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator, and making all required calculations from the diagram; also the principles of economy in operating steam engines, and current practice in testing engines and boilers. Price $2, postpaid. Published by John Wiley & Sons, 15 Astor Place, New York.

"Binders" for the AMERICAN MACHINIST. Two styles—the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers, the full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUB'G CO., 96 Fulton st., New York.

The series of articles by J. G. A. Meyer, on "Practical Drawing," now running in the AMERICAN MACHINIST, should be closely followed by every student. They commenced with October 23, 1886 issue, and up to and including August 11, 1888 issue, 56 articles have been so far published. Copies containing these articles, sent by mail to any part of this country or Canada, at 5 cents each. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton st., New York.

"Modern Locomotive Construction," by J. G. A. Meyer. The above series of articles, now running in the AMERICAN MACHINIST, are attracting the attention of railway mechanics all over the world. Commencing with the June 27, 1885 issue, 70 articles have thus far appeared up to and including the August 4, 1888 issue. Copies containing these articles sent by mail to any part of the U. S. or Canada at 5 cents each. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton st., New York.

MANUFACTURES

The city of Decatur, Ala., will build gas works.

The Pacific Mills, Lawrence, Mass., will erect a new spinning mill.

Suburban water-works are contemplated at Chattanooga, Tenn.

James E. Barry will build an addition to his foundry at Norfolk, Va.

The Tunis Lumber Company, Norfolk, Va., will build a kindling wood factory.

The Syracuse (N. Y.) carriage factory are looking towards removing to Kansas City, Mo.

D. Morrison & Co., will put an engine and boilers into the Standard Mills, at Minneapolis, Minn.

The Lake Shore Foundry Company, Chicago, Ill., has been organized, to make small iron castings.

A company has been organized to build chair works at Chattanooga, Tenn. R. C. Huntington is interested.

Geo. Whiting, of Menasha, Wis., has purchased water-power on the Wisconsin river, and will erect pulp and paper mills.

The production of pig iron for the first six months of 1888 shows a falling off as compared with the first half of the year 1877.

The D. Mackintosh & Sons Company has been organized at Holyoke, Mass., with a capital of $100,000, to carry on the dyeing business.

The Chattanooga (Tenn.) Wood Vulcanizing Company has lately been organized. The company expects to begin building works at once.

The John P. King cotton mill, of Augusta, Ga., ships about $250,000 worth of cotton goods a year to China. The freight to Shanghai is $1.63 per hundred.

Michigan parties have lately purchased a site at Greensburg, La., with good railroad facilities, to build a saw-mill with a daily capacity of 75,000 feet.

The new silk mills of the Phœnix Manufacturing Company, at Pottsville, Pa., equipped at a cost of $250,000, have begun operations, employing 1,000 hands.

A $50,000 company has been organized at San Antonio, Texas, for the manufacture of pressed brick. This is said to be the first enterprise of the kind in Texas.

The Midway Machine Works, South Anniston, Ala., are settled in their new shops. They have a brass foundry 50 x 70 feet; also finishing shop and pattern shop.

The Bloomington Builders' Supply Company, Bloomington, Ill., has been incorporated, with a capital stock of $10,000, to deal in lumber and building materials.

The Novelty Wood-Working Company, of Minneapolis, Minn., has been incorporated by Neil Jordan, Thomas L. Hewitt and Geo. W. Weston, with a capital stock of $15,000.

Charles Fuller and others, of Ludell, Kas., have organized the Fuller Manufacturing Company, with a capital stock of $10,000, for manufacturing iron, wood and paper novelties.

Joseph Clarkson & Son are putting up a building four stories, 56 x 100 feet, at Baltimore, Md., to be used as a machine shop for the manufacture of wood-working machinery.

Thomas Medgley, who has for some time been experimenting in the manufacture of wire belting, has associated himself with others, and will build works at Beaver Falls, Pa.

According to the Anniston (Ala.) *Hot Blast*, the manufacturing capital of Anniston is $10,000,000, which is an amount in excess of the total capital invested in the State in 1880.

D. W. Hughes, H. S. Chamberlain, John L. Divine, M. Block, John T. Bradford, and others, have incorporated the Chattanooga Wood Vulcanizing Company at Chattanooga, Tenn.

The Westinghouse Machine Company, Pittsburgh, Pa., have issued a very neatly arranged circular of their compound engines. The circular contains cuts of the engine, and accounts of tests made.

The Aluminum Brass and Bronze Company, of Waterbury, Conn., will locate their new works at Bridgeport, Conn. The proposition is to erect large works there, including a rolling mill for brass, German silver, copper, etc., also a wire mill.

The Laidlaw & Dunn Company, of Cincinnati, Ohio, have received a contract to furnish all the pipe, fittings, valves, heaters, pumps, etc., for the Addyston Pipe and Steel Co.'s large new works, now being erected at Addyston, Ohio, a suburb of Cincinnati.

The Jacksonville (Ala.) Mining and Manufacturing Company own large tracts of land. This company binds itself to devote one-half the proceeds of land sales to establish manufacture, and not to declare dividends until a specified amount has been invested in manufacture.

The Whitin Machine Company, Whitinsville, Mass., put in last fall a 35 arc light plant, made by the Waterhouse Electric and Manufacturing Company, Hartford, Conn. This order has recently been increased to the extent of 135 additional lights, each 1,700 candle power.

The Cadillac Veneer Box Company, Cadillac, Mich., has been organized, with a capital stock of $50,000. The stockholders are Jacob Cummer, Wellington W. Cummer, W. M. Gow, Fred S. Kieldsen and John C. McLaughlin. The company will make a patent angle-wood crate-frame box.

The Mason Machine Company, of Taunton, have recently added a big emery surface planer 24 feet long to do surface work 18 feet long, made by the Springfield Glue and Emery Wheel Company, of Springfield, Mass. It weighed eight tons and is, the manufacturers think, the largest machine of the kind ever made in this country.

The Tyler Tube Works, Boston, Mass., recently shipped an invoice of steel tubes to Glasgow, Scotland. In an interview, William P. Tyler says the steel for these tubes is brought from England, and the manufactured article sent back. Why this can be done is, he says, because of better appliances for manufacturing and more efficient labor.

Contracts have been signed for the removal of the Favorite Stove Works of Cincinnati to Piqua, Ohio. The town of Piqua has agreed to erect the necessary buildings for the new plant of the company on eight acres of ground donated for the purpose, supply them with natural gas for ten years and bear the expense of 250 carloads of freight from the old works.

Water-works agitation is going on at Whitney, Neb.; Fremont, Neb.; Charleston, W. Va.; Sheffield, Ala.; Vinton, Iowa; Sutton, Neb.; Ouray, Col.; Tuscarora, Neb.; Edinburg, Ind., Mankato, Minn.; Broken Bow, Minn; Banca, Cal.; Fairbury, Neb.; Austin, Cal.; Cherokee, Iowa; Luray, Va.; Knightstown, Indiana; Milford, Mass.; West Branch, Mich.; Vassar, Mich.; Lexington, Va.

At the Riverside Works, Wheeling, W. Va., the plate, bar and guide mills, and the steel works, are on full, and all full turns. The full capacity of the steel department is being tested to meet the demand for steel pipe, which seems to be rapidly superseding all other kinds. Recently in one week they shipped 52 car loads of steel pipe alone, besides large shipments of their other products.

The San Diego Iron and Nail Manufactory, located at Roseville, Cal., and the immense buildings to be occupied, are nearing completion. These buildings will cover four acres of ground, and will be very substantial in character. When in working order the factory will use 25 tons of iron and turn out 500 kegs of nails daily. One hundred men will be employed. The company has a capital of $250,000.

Work has commenced on the new shops of the New York, Pennsylvania and Ohio Railroad at Briar Hill, Ohio. The contract for their construction has been awarded to Drake, Shattuc & Co., of Pittsburgh, who also have the contract for double-tracking of the road from Youngstown to Cleveland. The company has bought 36 acres for the shops, and expects to have them ready to be occupied by November 1.

Articles of association of the Blackmore Manufacturing Company, Grand Rapids, Mich., were filed recently. The company is organized for the purpose of "manufacturing and dealing in photographic apparatus and material, prescriptions, cases, mouldings of all kinds, picture frames and mirrors and mirror frames, and materials for manufacturing said articles." The capital stock is fixed at $100,000, with $15,000 paid in. J. J. Blackmore, of St. Thomas, Ontario, H. Blackmore and J. E. Blackmore, of Grand Rapids, are the incorporators.

Daniel T. Kelley, the well-known Portland (Maine) iron founder and manufacturer of agricultural implements, is to build at once a large iron foundry on Back Bay. The building will be 145x65, and the latest machinery for the manufacture of mowing machines and other agricultural implements will be put into the foundry, in which about twenty-five experienced workmen will be employed. Mr. Kelley will continue to operate his foundry on Cross street, and when the new foundry is completed, he will have, all told, in his employ some forty men. Mr. Kelley has manufactured mowing machines for the Western market some time, and he will now turn his attention to supplying the home demand.

A press dispatch says: A party of Pittsburghers who have visited the new roaring gas well of the Philadelphia company, back of Canonsburg [Pa.], say that, according to the registered pressure, the well is the largest in the world. The gas looks like a solid piece of blue steel for some distance after it comes out of the pipe. Solid masonry 13 feet thick was put in around the top of the well to hold the cap on. The tools and rope thrown out were, perhaps, the heaviest of any yet moved in that way. The iron in the tools weighed 3,000 pounds. The wet rope, nearly 2,000 feet long, weighed as much more, but all was thrown up like a rocket, the rope coiling around the ruins of the derrick like so much yarn.

The Grand Rapids, Mich., *Telegram-Herald* has this to say of a new carving machine: Probably no more perfect and complete machine is to be found than a new carving machine patented by Post & Smith, of Milwaukee, and manufactured by the Milwaukee Carving Company. A number of the manufacturers here are using the machines. The Phœnix has three machines, which were shown and explained to a reporter yesterday. The machine is provided with two spindles attached to flexible shafts which make 14,500 revolutions a minute. The flexible shafts allow the spindles to be held in any position that a hand carver would hold his chisel without interfering with their rate of motion, and the movable frame upon which the machine is hung allows the spindles to be moved to any part of the work. In the center of the machine is a spindle which does not cut, but simply follows the pattern which is being carved. The spindles are of such fine workmanship that they are made in watch factories with watchmakers' tools. The shafts and the spindles alone for one machine cost $150, although they are so small that they can be held between the thumb and finger. The amount of work done by one of these machines can be judged from the fact that a boy running one of them will turn out from $25 to $30 of carving that would cost that amount if done by hand. The work when finished can scarcely be told from hand carving. The machines at the Phœnix are under the immediate foremanship of Charles Young.

Machinists' Supplies and Iron.

New York, July 26, 1888.

Iron—American Pig—The general characteristic feature of the market is dullness, though there is a steady sale for some of the best brands. We quote Standard Lehigh and North River brands $17.50 to $18.50 for No. 1 X Foundry, $16.50 to $17.50 for No. 2, and $15 to $16 for Grey Forge.

✻WANTED✻

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Wednesday morning for the ensuing week's issue.

Wanted—Men to examine S. S. planes; see p 11.

Wanted—Position by a foreman pattern maker; best reference. Box 6, Am. Machinist.

A designer and draftsman wants a situation; is graduate from technical school, and has experience as machinist. Address K., Am. Machinist.

Situation wanted by first-class machinist and tool maker; one who understands taking charge of help. Address Box 4, American Machinist.

Wanted—Position as foreman of machine shop, or to build tools and machinery by contract; A1 reference. Address Letter Carrier 355, Dorchester, Mass.

Experienced foundry foreman desires to contract with a responsible firm, to make work by the ton, or will take charge; highest references. Address Box 7, American Machinist.

Wanted—Five or six good machinists for piece work, who are familiar with the manufacture of wood-working machinery; none others need apply. Address Chance, American Machinist.

Wanted—By a thoroughly competent machinist, a position as foreman; understands laying out work and the handling of men to best advantage. Address Push, American Machinist.

Wanted—By practical man, situation as foreman of iron foundry; has had large exp. as such in making all kinds of machinery and general jobbing castings; good ref. Foundry Foreman, Am. Machinist.

Wanted—Situation as foreman blacksmith, by a man of long experience on engine work; would take shop by contract; held similar situation 12 years; good references. Box 5, Am. Machinist.

Wanted—Situation to represent mfrs. in New York, by a gentleman with long experience in machinery, engines, and supplies, and would travel part of the time; can give best of references as to ability, integrity, etc. Address A. L. B, Am. Machinist.

Wanted—A thoroughly competent salesman well posted on iron-working and wood-working machinery, steam engines and boilers, steam pumps, etc.; good salary and permanent position for right man. Address John R. Wilberton, P. O. Box 16, Portland, Oregon.

Wanted—For good permanent position, a good man thoroughly experienced in the different branches of fine machine work and tool making; one having knowledge of drafting preferred. Address, stating age, etc., Charles Hutchinson, Detroit Electrical Works, Detroit, Mich.

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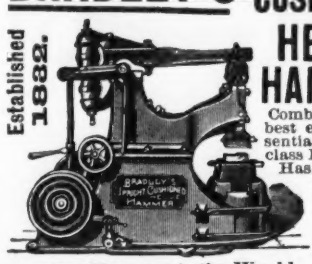

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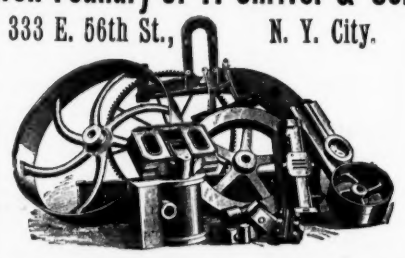

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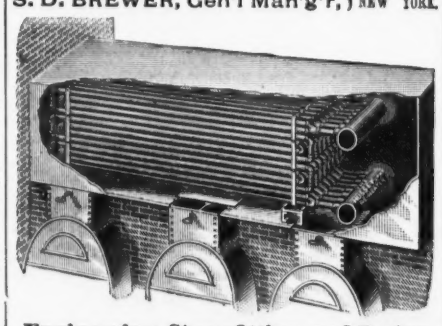

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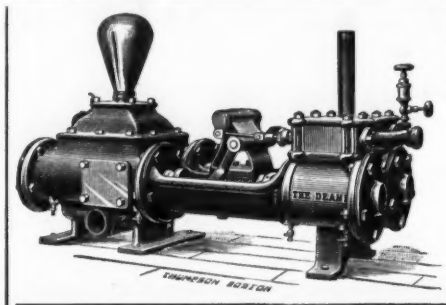

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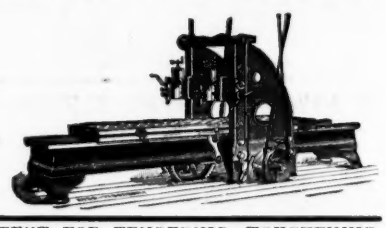

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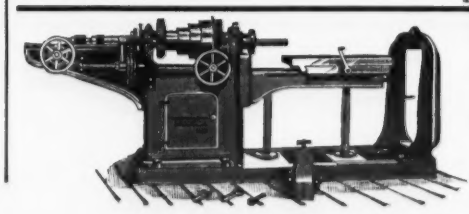

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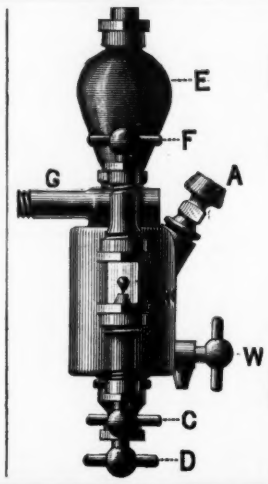

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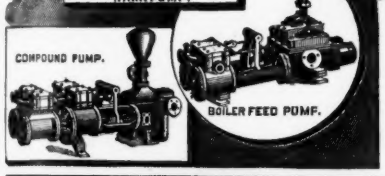

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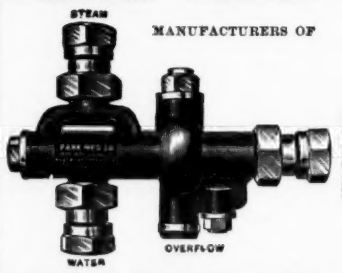

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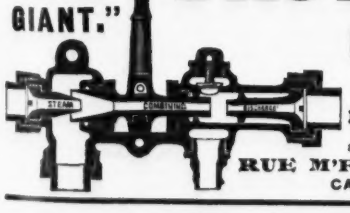

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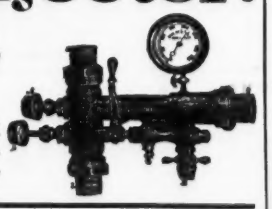

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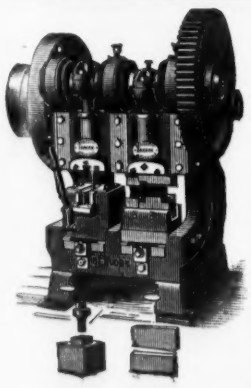

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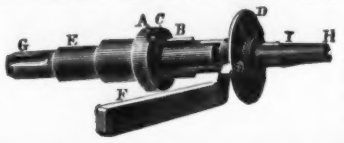

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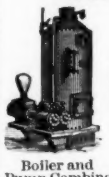

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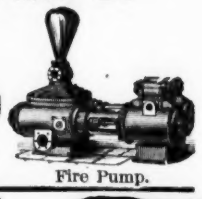

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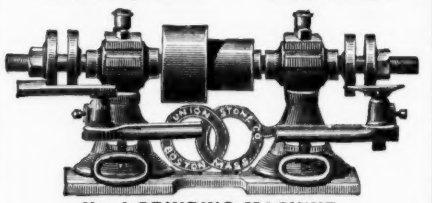

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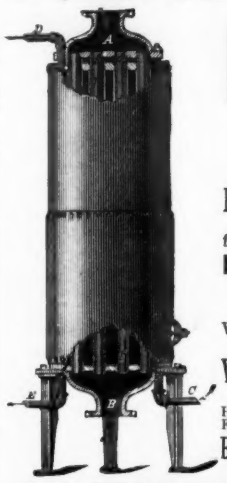

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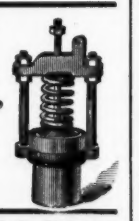

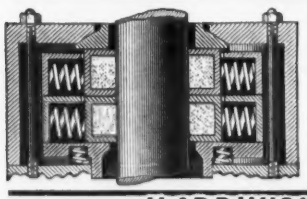

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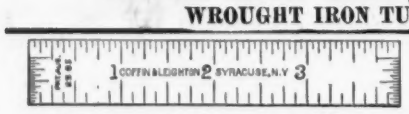

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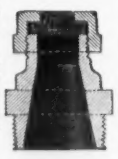

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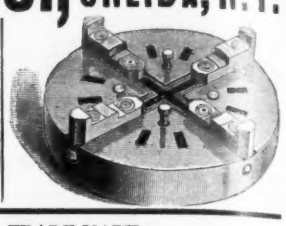

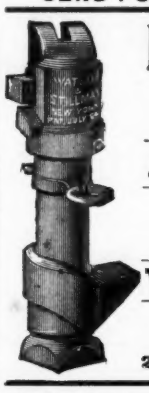

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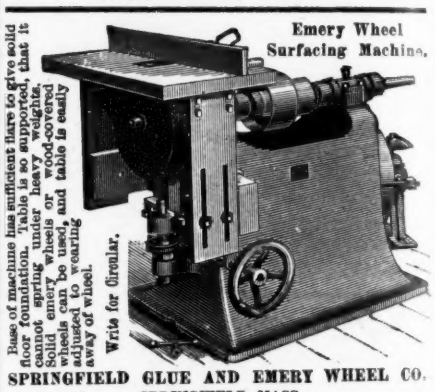

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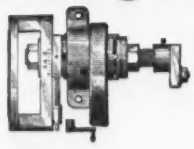

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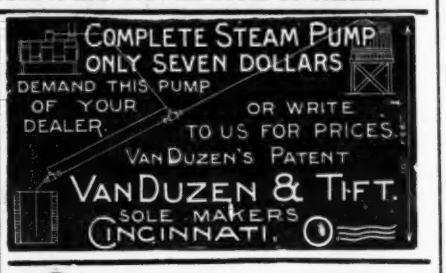

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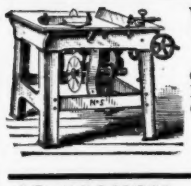

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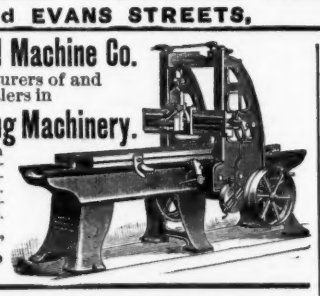

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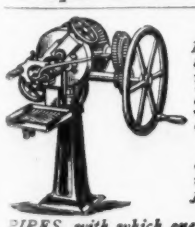

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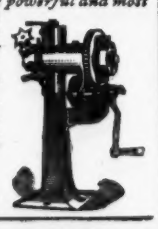

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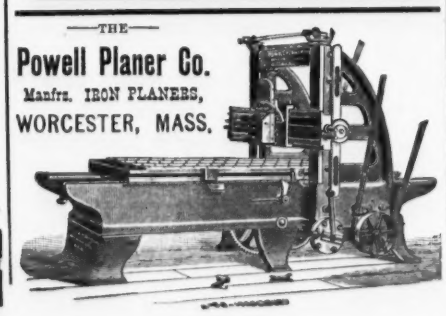

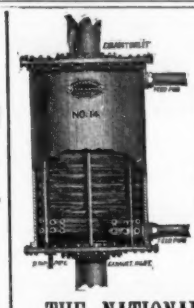

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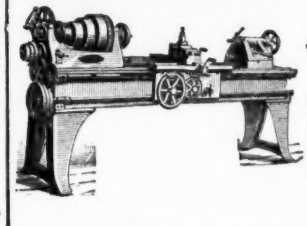

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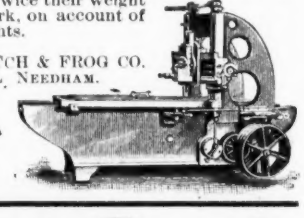

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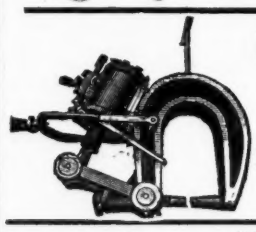

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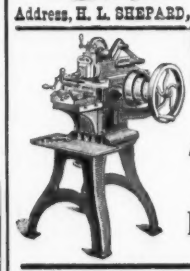

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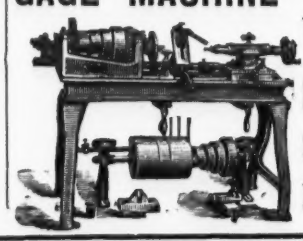

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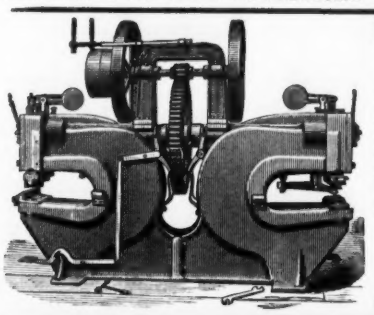

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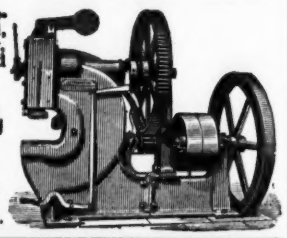

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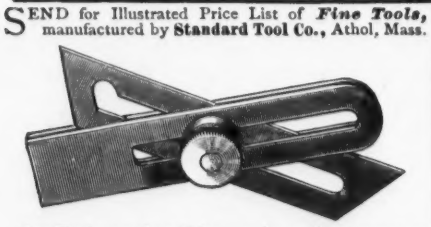

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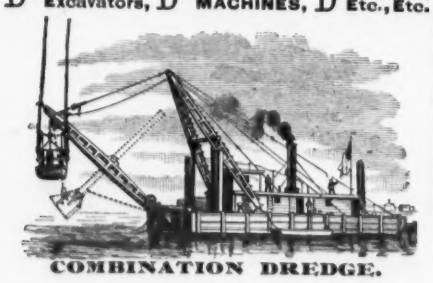

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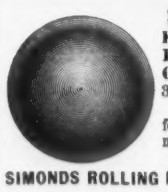

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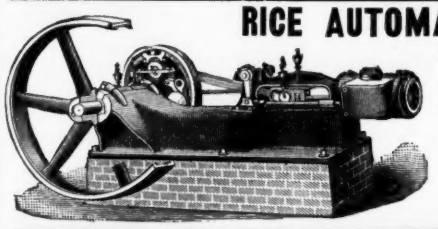

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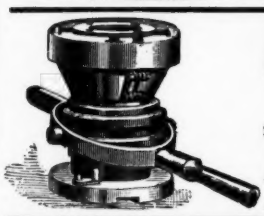

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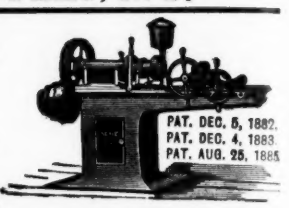

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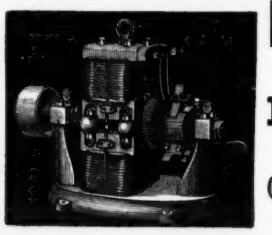

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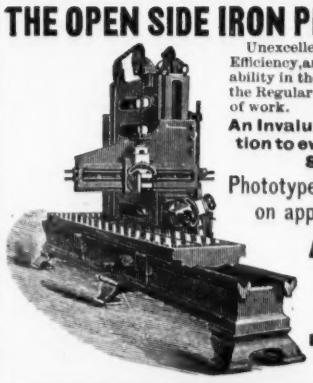

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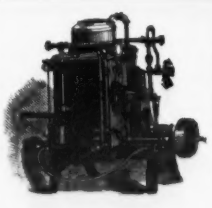

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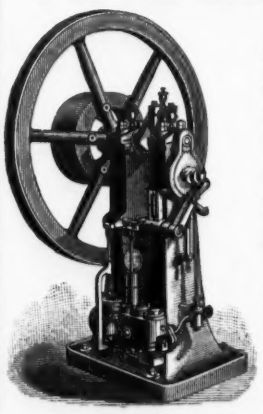

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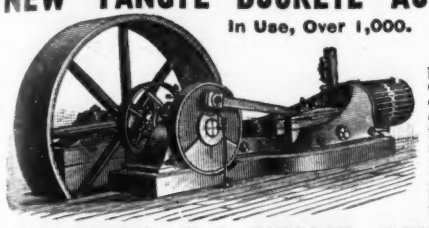

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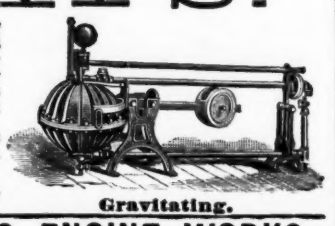

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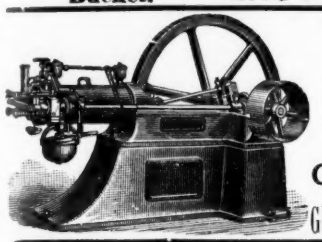

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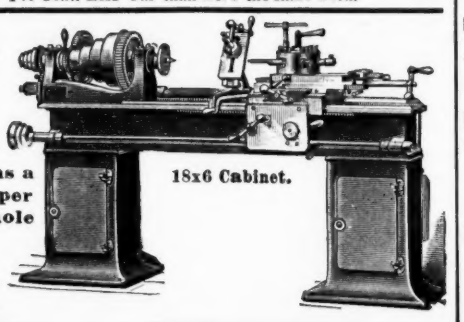

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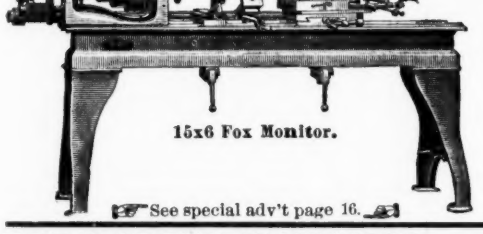

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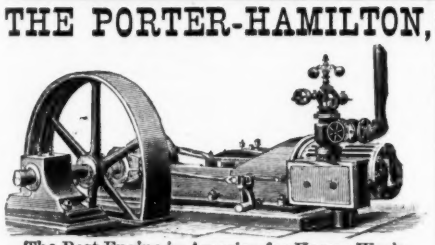

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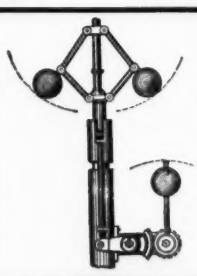

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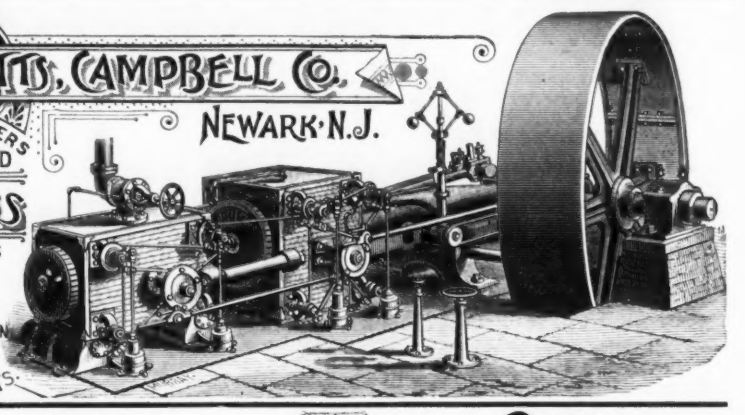

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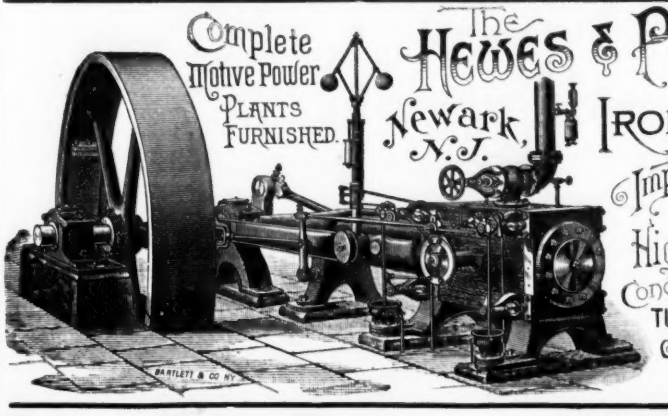

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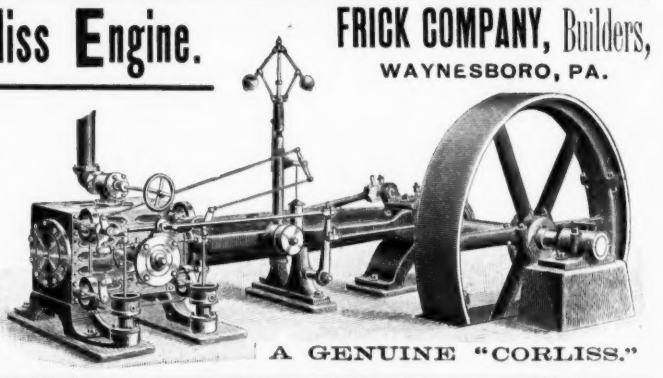

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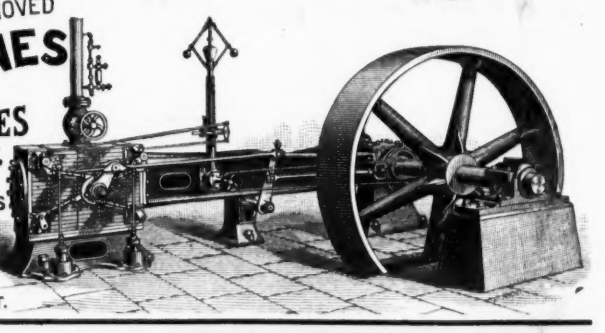

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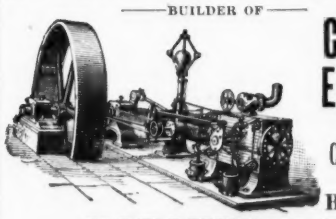

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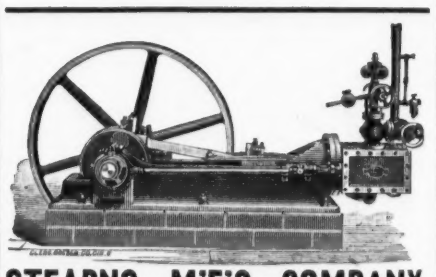

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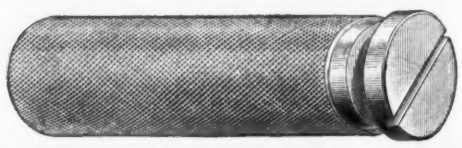

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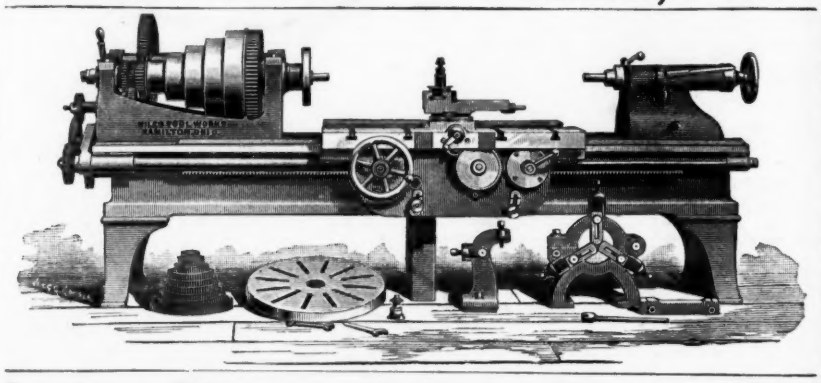

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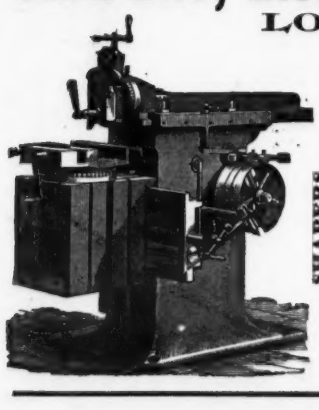

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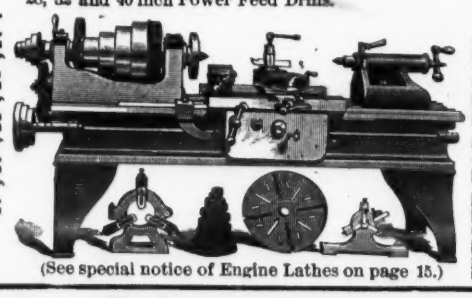

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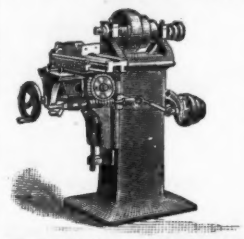

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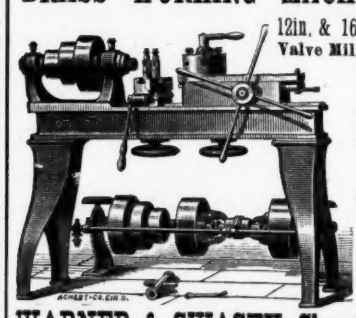

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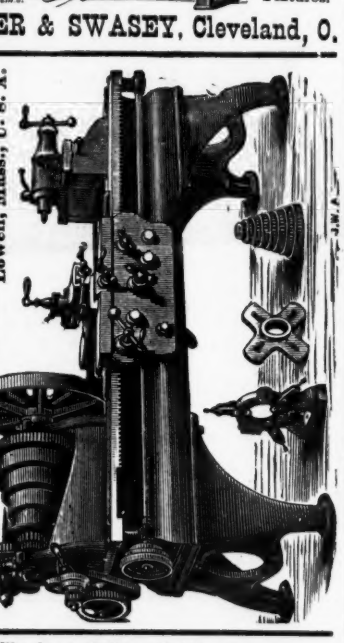

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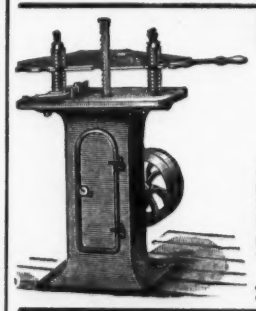

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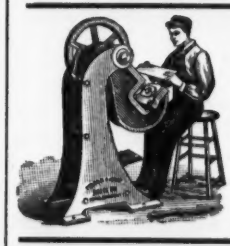

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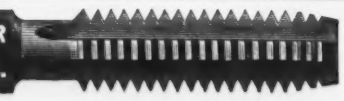

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